CONTRA COSTA COUNTY

Active Transportation Corridor Study Appendices

DRAFT | JANUARY 2020

IRON HORSE REGIONAL TRAIL

Contents

IRON HORSE TRAIL ACTIVE TRANSPORTATION CORRIDOR STUDY

TECHNICAL MEMORANDUM #1 EXISTING CONDITIONS

February 27, 2019

PROJECT BACKGROUND

The Iron Horse Trail Active Transportation Corridor Study is conducting an in depth analysis and evaluation of the Iron Horse Trail as an active transportation corridor. The study will evaluate how investment in the corridor, its crossings with the street network, and connections to the trail can increase the share of trips being made using active modes to get to work, school, shopping, and other utilitarian purposes. This memorandum presents existing conditions for the trail.

The Iron Horse Trail (IHT) offers tremendous potential as a transportation corridor through the heart of Contra Costa County. The full corridor is within 1.5 miles of over 340,000 residents (151,000 commuters) and only a few blocks from both the Pleasant Hill and Dublin/Pleasanton BART stations. The IHT directly connects workers to dense employment areas like Bishop Ranch in San Ramon (600 companies and growing) and Contra Costa Centre Transit Village in Walnut Creek (over 6,000 employees).

The trail is generally a 10-foot wide paved path, requiring pedestrians and bicyclists to share the same space. The trail's popularity at peak times has led some bicycle commuters to seek alternate routes. For others, the lack of low-stress on-street connections serves as an impediment to using the Iron Horse Trail for commuting and other utilitarian trips.

The IHT Corridor Study presents an opportunity to reimagine the existing trail into an active transportation mobility corridor for the future. With limited roadway space and high costs to adding new freeway or similar auto-oriented infrastructure, finding ways to create new mobility options that include active transportation, low power electric vehicles and micromobility devices, and shared autonomous vehicles is critical to improving future sustainability of the transportation system.

This memorandum summarizes the data reviewed, key trends, issues, and constraints, with a focus on the physical corridor.

CORRIDOR HISTORY AND OWNERSHIP

The existing trail corridor follows the Southern Pacific Railroad right-of-way established in 1891 and abandoned in 1978, and currently spans 32 miles, passing through the communities of Concord, Pleasant Hill, Walnut Creek, Alamo, Danville, and San Ramon, as well as Dublin and Pleasanton (Alameda County). The scope of the Study includes the entire length (approximately 22 miles) of the Iron Horse Trail within Contra Costa County (State Route 4 to County Line). While the Iron Horse Regional Trail begins in Concord near Highway 4, it should be distinguished from the Iron Horse Corridor (approximately 18.5 miles) that begins in Concord at Mayette Avenue.

The Iron Horse Trail corridor is owned by Contra Costa County, though several easements for underground utilities lie within the corridor. These utilities are a major constraint to potential upgrades to the corridor. Primary utility easements include:

- A 10 to 36-foot Contra Costa Sanitary District easement traverses the majority of the corridor
- A 10-foot gas pipeline easement, granted to SFPP/Kinder-Morgan, runs along the majority of the corridor
- Intermittent PG&E easements for underground vault access or overhead power lines are present throughout the corridor
- There are sporadic storm drain easements perpendicular to the trail and East Bay Municipal Utilities District water lines within the corridor.

TYPICAL CORRIDOR CONDITIONS

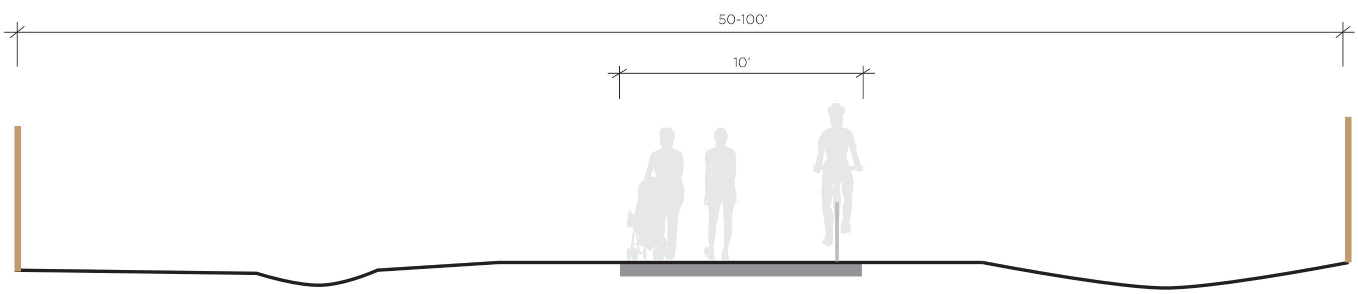
The Iron Horse Trail corridor typically ranges between 50’-100’ in width as it follows the old Southern Pacific Railroad right-of-way. The trail itself is 10 feet wide and is typically an asphalt surface. Portions of the corridor include informal unpaved shoulders and connections to surrounding land uses. A few locations include separate formal pedestrian paths that are either compacted natural surface or asphalt paths ranging from 3 to 5 feet in width.

The topography along the trail corridor is generally flat as it follows the old railroad grade. Three common corridor conditions are described immediately below. Descriptions of unique conditions found in only select locations are included in the following pages. The map on page 6 summarizes these conditions.

UNCONSTRAINED CORRIDOR

2.9 miles

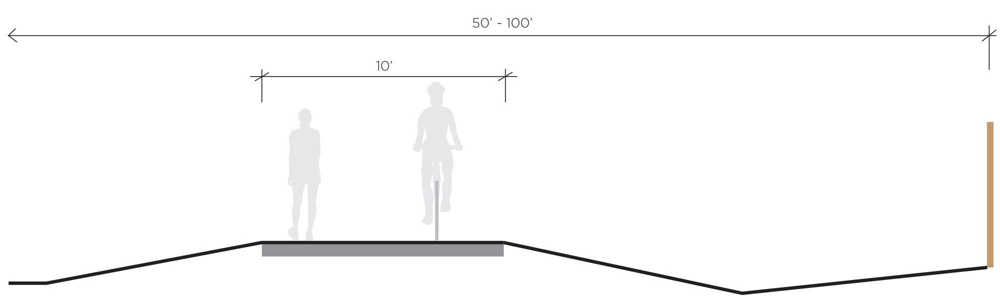
A portion of the corridor faces few constraints, with 50 to 100 feet of generally flat right of way available. Relevant sections of this type are found near Walnut Creek and Alamo.



FORMER RAIL BED

7.8 miles

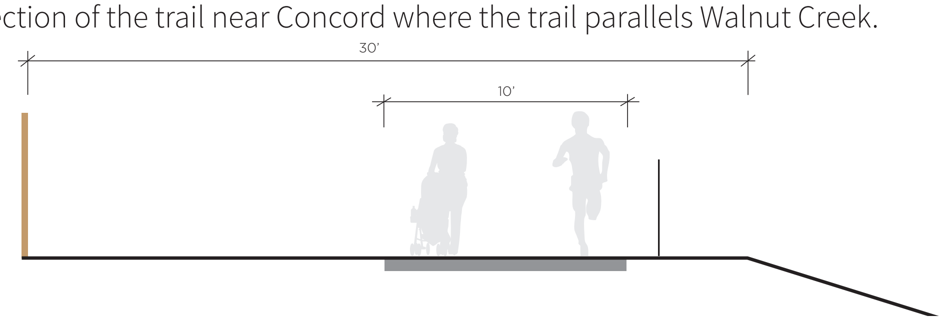
Sections of the trail run along a raised rail bed with moderate drainage ditches along portions of the corridor. These conditions are found in most of San Ramon and Danville.



TRAIL ON BERM

3.6 miles

The third common trail condition is on a raised berm. This is primarily found in the northern section of the trail near Concord where the trail parallels Walnut Creek.

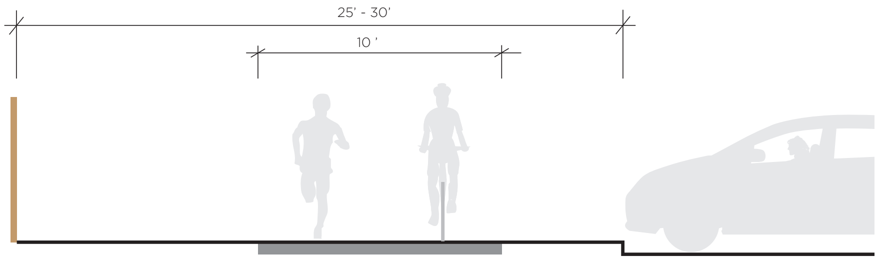


UNIQUE CORRIDOR CONDITIONS

Several areas of the corridor face constraints from adjacent commercial development, limited right of way, a channelized creek, or topography. There are also a few examples of the trail traversing through parks. The following examples illustrate these unique corridor conditions.

ADJACENT COMMERCIAL

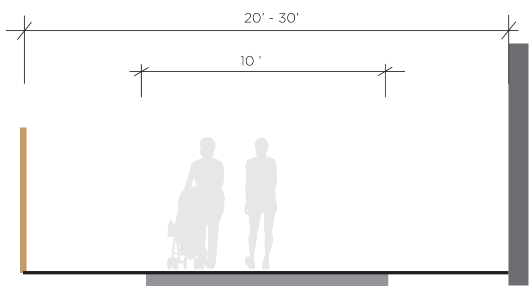
For 2.3 miles in parts of Danville and San Ramon, commercial businesses are directly adjacent to the trail. In Downtown Danville, the trail narrows to approximately 30 feet in width.



DOWNTOWN DANVILLE

LIMITED RIGHT-OF-WAY

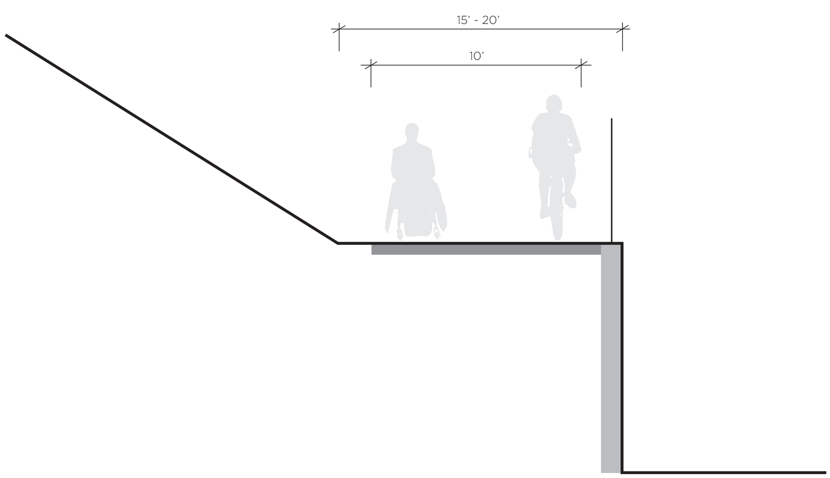
For just under a mile in south Walnut Creek, South Broadway and the adjacent soundwall narrow the trail corridor width to approximately 20 feet.



WALNUT CREEK - SOUTH BROADWAY CORRIDOR

CHANNELIZED CREEK

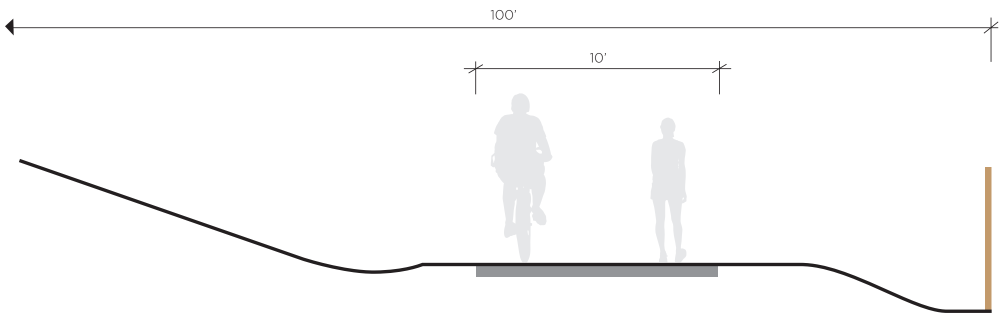
The trail corridor is approximately 25 feet wide adjacent to the channelized creek between Newell Avenue and Ygnacio Valley Road in Walnut Creek (0.7 miles).



WALNUT CREEK - NEWELL TO YGNACIO VALLEY ROAD

ADJACENT TOPOGRAPHY

While most of the trail is in generally flat topography, a small portion (0.8 miles) in Danville is adjacent to topography that may limit any additional trail width.

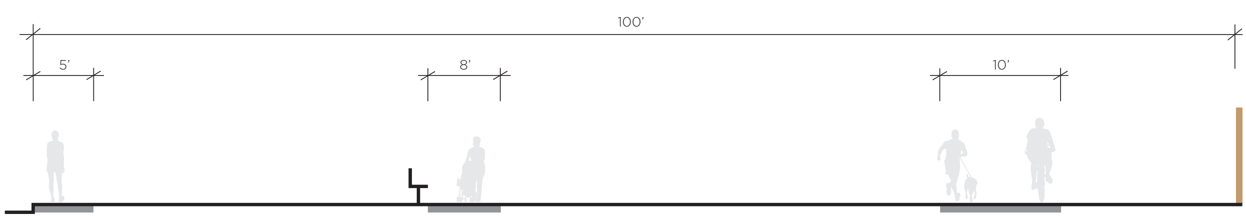


DANVILLE - HILLGRADE TO DANVILLE BLVD

TRAIL THROUGH PARK

In several locations, the trail crosses through or adjacent to a community park or other similar space, including in Pleasant Hill near the BART station and Central Park in San Ramon. The trail also traverses the San Ramon Golf club and currently includes fencing adjacent and overhead to protect users from errant golf balls.

PLEASANT HILL - CONTRA COSTA CENTRE TO MAYHEW WAY



CORRIDOR CONDITIONS

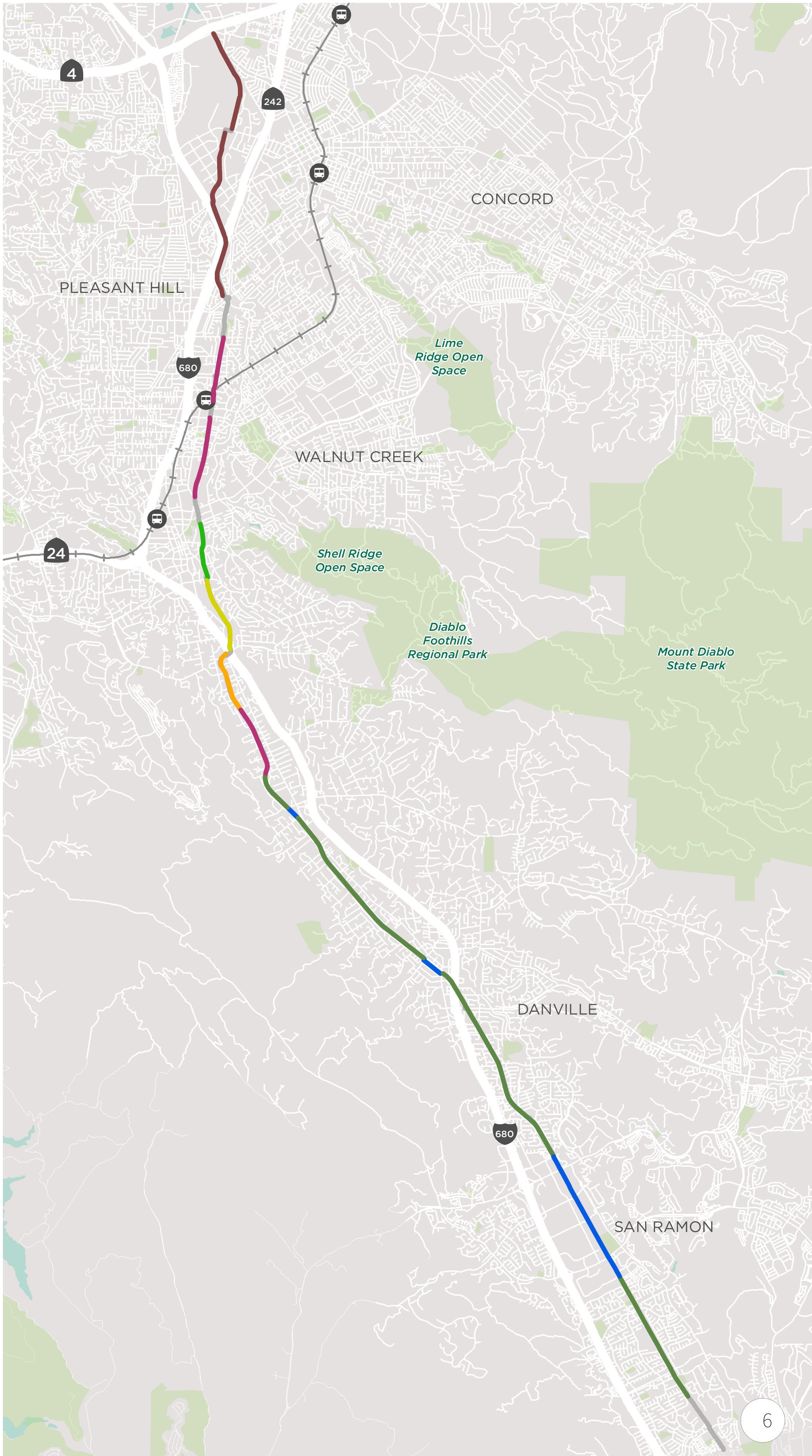
CONTRA COSTA COUNTY
IRON HORSE TRAIL

Trail Typology

- **Very Wide** (2.9 miles)
- **Wide:** Trail on Creek Bank (3.6 miles)
- **Wide:** Rasied Rail Bed (7.8 miles)
- **Narrow:** Adjacent Topography (.08 miles)
- **Narrow:** Adjacent Commercial (2.3 miles)
- **Constrained:** Limited Right of Way (1 mile)
- **Constrained:** Channelized Creek
- Iron Horse Trail
- BART Station
- Park

0 1 2 MILES

N



alta PLANNING + DESIGN

Map produced January 2018.
Sources: U.S. Census, Esri, Contra Costa County.

TRAIL CROSSING LOCATIONS AND EXISTING CROSSINGS

The Iron Horse Trail corridor crosses 45 roadways as it traverses Contra Costa County. For the purposes of the Study, we have broken down the crossing types into 5 categories, summarized in the map on page 8.


Crow Canyon Rd, San Ramon

Arterial

Generally multi-lane high speed (>35mph) roadway. Trail crossings utilize existing traffic signals. There are 11 major arterial crossings along the corridor.


El Capitan with RRFB, Danville

Collector Controlled

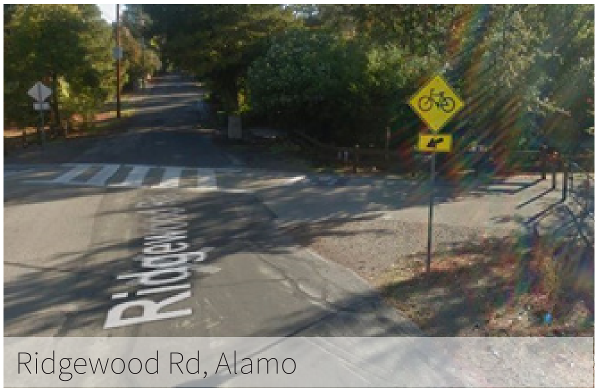
Connection between local and arterial road. Moderate speed and traffic volumes. Trail crossing typically controlled by RRFB or other flashing beacon. There are 9 controlled crossings along the corridor.


Walden Rd, Walnut Creek

Collector Uncontrolled

Connection between local and arterial road. Moderate speed and traffic volumes. Trail crossing warning signage and striping only. There are 6 uncontrolled crossings along the corridor.

TRAIL CROSSING LOCATIONS AND EXISTING CROSSINGS



Ridgewood Rd, Alamo

Local

Neighborhood/residential access only. Low speed (25 mph) and low traffic volume. Trail crossing warning signage and striping only. There are 14 local crossings, many clustered together.

Treat Blvd , Walnut Creek

Grade Separated

Trail crosses under or over roadway. There are two existing overcrossings and three roadway undercrossings along the corridor.

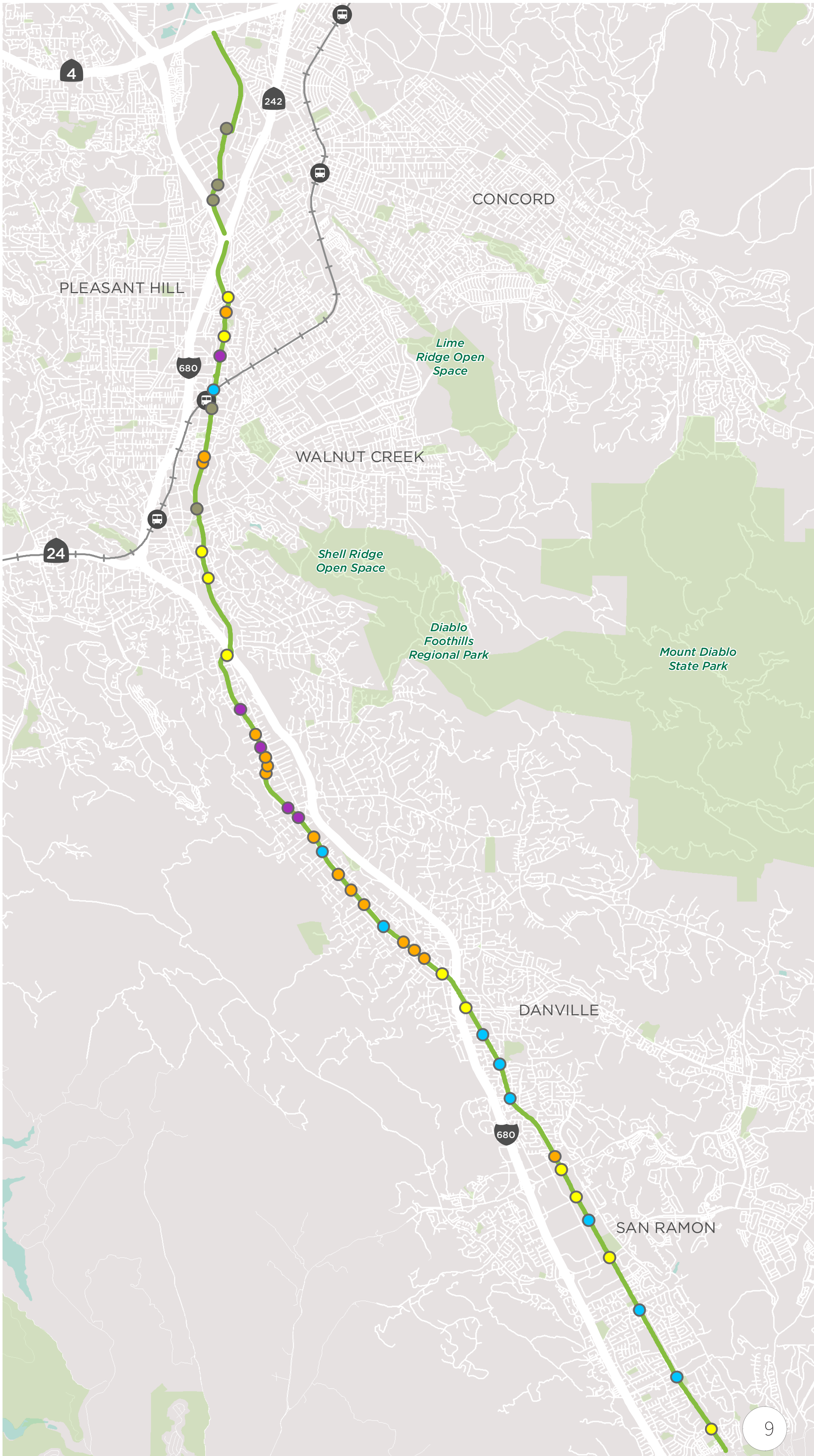
INTERSECTIONS

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Intersection Type

- Arterial
- Collector Controlled
- Collector Uncontrolled
- Local
- Grade Separated

- Iron Horse Trail
- BART Station
- Park



0 1 2 MILES

N

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PLANNING + DESIGN

Map produced January 2018.
Sources: U.S. Census, Esri, Contra Costa County.

ACCESS POINTS

The Iron Horse Trail has numerous access points, including formal public access points from city streets or shopping areas, areas that are permeable (where the trail passes through parks or other open land areas), informal public access points to shopping centers that do not formally open onto the trail, and informal private access points to individual homes along the trail. This Study is primarily focused on formal/public access points, though the relationship between other public and private land to the trail will also be addressed. There are 60 formal access points along the corridor that connect the trail to residential neighborhoods, retail centers, downtowns, and parks. The map on page 11 illustrates these access points.

Fallen Leaf Circle, Danville

Residential

Access between trail and adjacent neighborhoods

Civic Drive, Walnut Creek

Local Street

Access between trail and local street network

Bishop Ranch, San Ramon

Business

Access between trail and office buildings or business park

ACCESS POINTS (CONTINUED)

Willows Shopping Center, Concord

Commercial

Access between trail and nearby retail centers

Greenbrook Elementary, Danville

Open Space/School

Access between trail and park space or an adjacent school

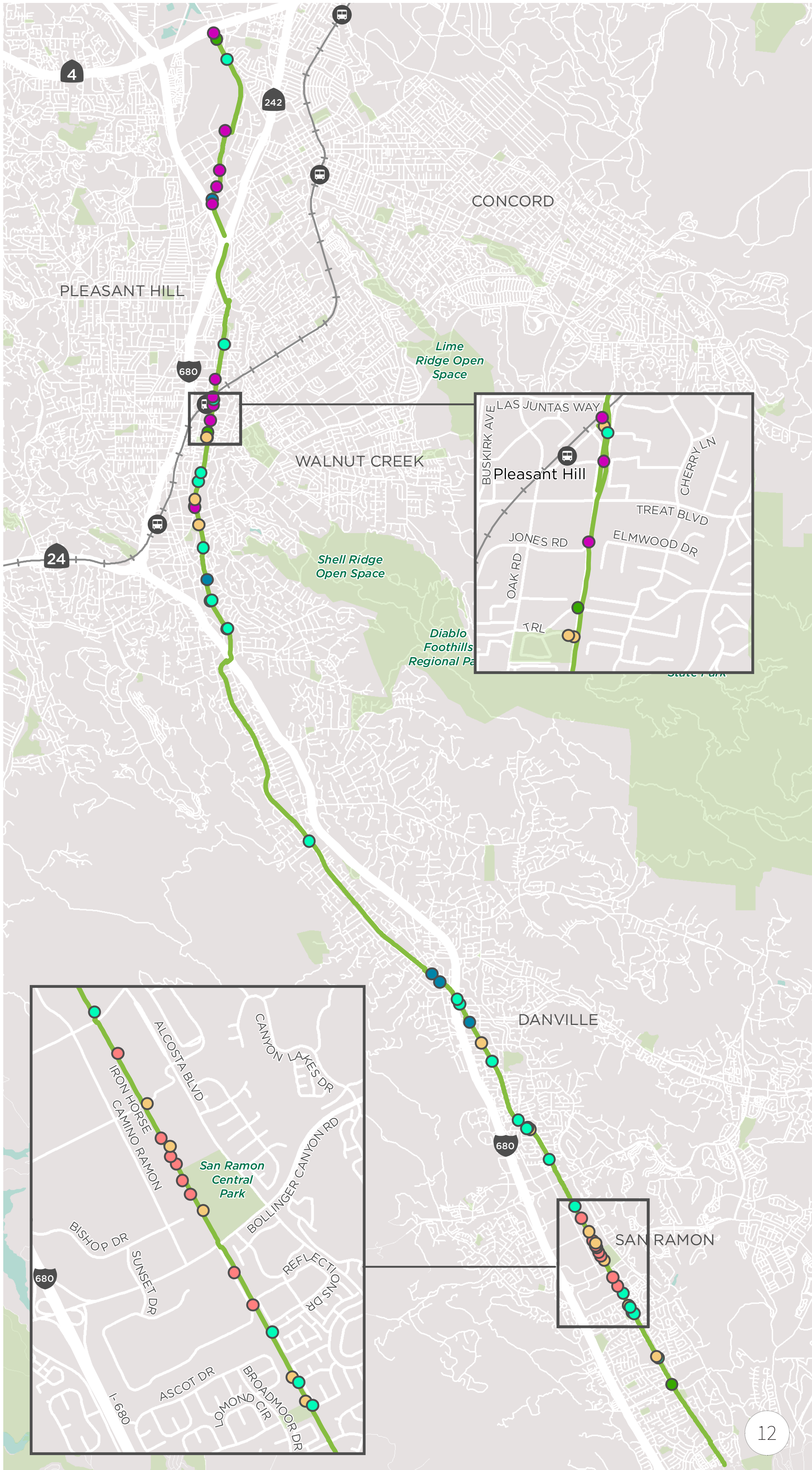
Contra Costa Canal Trail, Walnut Creek

Trail

Intersection of the Iron Horse Trail with another trail network

ACCESS POINTS

CONTRA COSTA COUNTY
IRON HORSE TRAIL



Access Type

- Business
- Commercial/Retail
- Residential
- School or Open Space
- Street
- Trail

Iron Horse Trail

BART Station

Park

MILES
0 1 2

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PLANNING + DESIGN

Map produced January 2018.
Sources: U.S. Census, Esri, Contra Costa County.

EXISTING AMENITIES

While the trail connects to several city parks, schools, and downtowns, amenities along the trail itself are scarce. Small staging areas with and without parking are sporadic along the corridor. Shade structures with seating are found adjacent to the trail within San Ramon, and there is enhanced greenway and linear park space north of the Pleasant Hill BART station. The San Ramon Transit Center and Hemme Park have restrooms and water open to the public and are directly adjacent to the trail, and there are seven restrooms at public park facilities less than a quarter mile from the trail (three in San Ramon, two in Danville, and two in Walnut Creek).

Linear Park

Shade Structure with Seating

Trailhead Staging Area

IRON HORSE TRAIL ACTIVE TRANSPORTATION CORRIDOR STUDY

TECHNICAL MEMORANDUM #2 CORRIDOR ANALYSIS

June 11, 2019

PROJECT BACKGROUND

The Iron Horse Trail Active Transportation Corridor Study is an in depth evaluation of the Iron Horse Trail as an active transportation corridor. The Study will evaluate how investment in the corridor, its crossings with the street network, and connections to the trail can increase the share of trips being made using active modes to get to work, school, shopping, and other utilitarian purposes.

This memorandum describes how the corridor is used today, focusing on how it provides access to workplaces, schools, shopping, and other key destinations. This memo addresses the following questions:

- What are the demographics of the communities along the Iron Horse Trail and how are they changing?
- What active transportation networks connect to the trail today?
- What locations are accessible from the trail by foot, bicycle, and other active modes?
- Who uses the Iron Horse Trail today and how heavily is it used?
- What safety issues exist along the trail or on connections to the trail?
- How well connected to the trail are each of the communities along it?

This Study presents an opportunity to re-imagine the existing trail into an active transportation mobility corridor for the future. With limited roadway space and high costs to adding new freeway or other auto-oriented infrastructure, finding ways to create new mobility options that include active transportation, low power electric vehicles and micromobility devices, and shared autonomous vehicles is critical to improving future sustainability of the transportation system.

DEMOGRAPHICS

The Iron Horse Trail offers tremendous potential as a transportation corridor through the heart of Contra Costa County. Within three miles of the Iron Horse Trail there are over 425,000 residents (200,000 commuters). This section reviews the demographics near the trail.

COMMUTING AND MODE CHOICE

Most walk and bike commute trips occur in the northern end of the trail, near Walnut Creek, Pleasant Hill and Concord (Map 1). Overall, however, 70 percent of commuters along the Iron Horse Trail corridor drive alone to work.

This may be due, in part, to the relative wealth of the communities along the Iron Horse Trail. People who live near the trail tend to have access to multiple vehicles, with only 2% of all commuters without access to a car, and 80% of commuters having access to 2 or more vehicles. Many of these motor-vehicle commute trips are relatively short, with 39% taking less than 20 minutes.

The largest concentrations of households with zero-vehicle (Map 2) and of relatively lower median household incomes (Map 3) are in the same census tracts with lower average drive alone to work mode share.

WHERE PEOPLE WORK AND LIVE

Using data from the US Census Bureau Local Employment Household Dynamics (LEHD) Origin-Destination Employment Statistics, Map 4 illustrates the spatial densities where people live and work. Within the Iron Horse Trail study area, jobs are concentrated in Walnut Creek and San Ramon, with a smaller cluster in Concord. However, workers' homes tend to be more dispersed along the trail between Concord, Pleasant Hill, and Walnut Creek.

Notably, many of the live and work hot spots are near the trail. For workers who both live and work in the study area, the Iron Horse Trail may provide a unique opportunity for long-distance car-free commuting.

POPULATION AND EMPLOYMENT GROWTH

Within the study area, population and employment growth are expected along the trail, near BART stations, and at the Concord Naval Weapons Station redevelopment site (Map 5). The significant growth in population near the trail further suggests the need to provide improved active transportation access in this corridor.

MODE OF TRANSPORTATION TO WORK

CONTRA COSTA COUNTY
IRON HORSE TRAIL

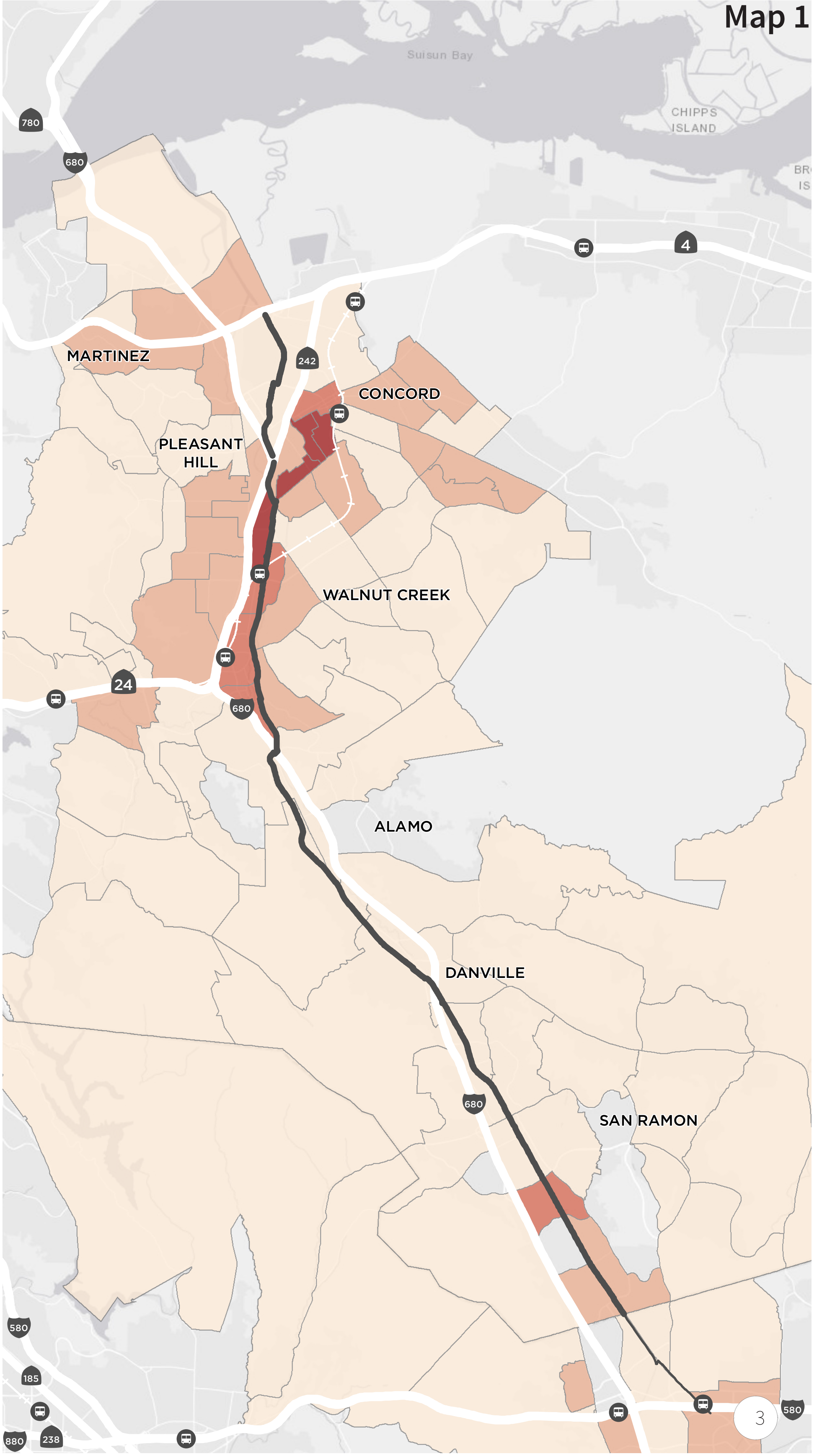
Walking and Biking to Work per Square Mile (Census tracts within 3 miles of Iron Horse Trail)

1 - 50
51 - 150
151 - 400
400 - 1,015

Iron Horse Trail
BART Station
Iron Horse Trail (Alameda County)

Zones not shown do not have data available.

0 1 2 MILES



Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, ACS 2016.

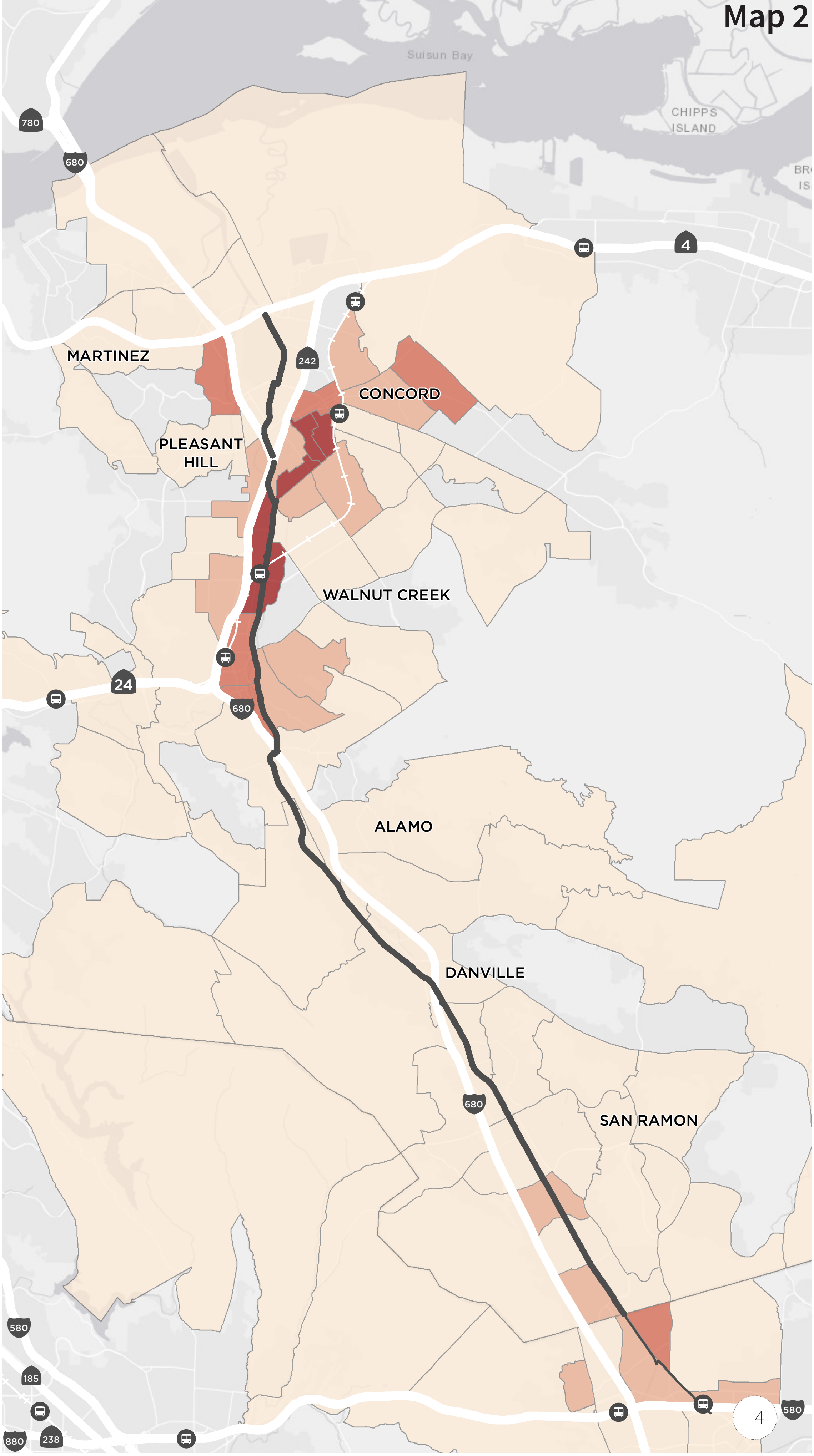
ZERO VEHICLE HOUSEHOLDS

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Zero Vehicle Households per Square Mile (Census tracts within 3 miles of Iron Horse Trail)

- 1 - 50
- 51 - 150
- 151 - 300
- 301 - 990

- Iron Horse Trail
- BART Station
- Iron Horse Trail (Alameda County)



Zones not shown do not have data available.

MILES
0 1 2

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Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, ACS 2016.

MEDIAN HOUSEHOLD INCOME

CONTRA COSTA COUNTY
IRON HORSE TRAIL

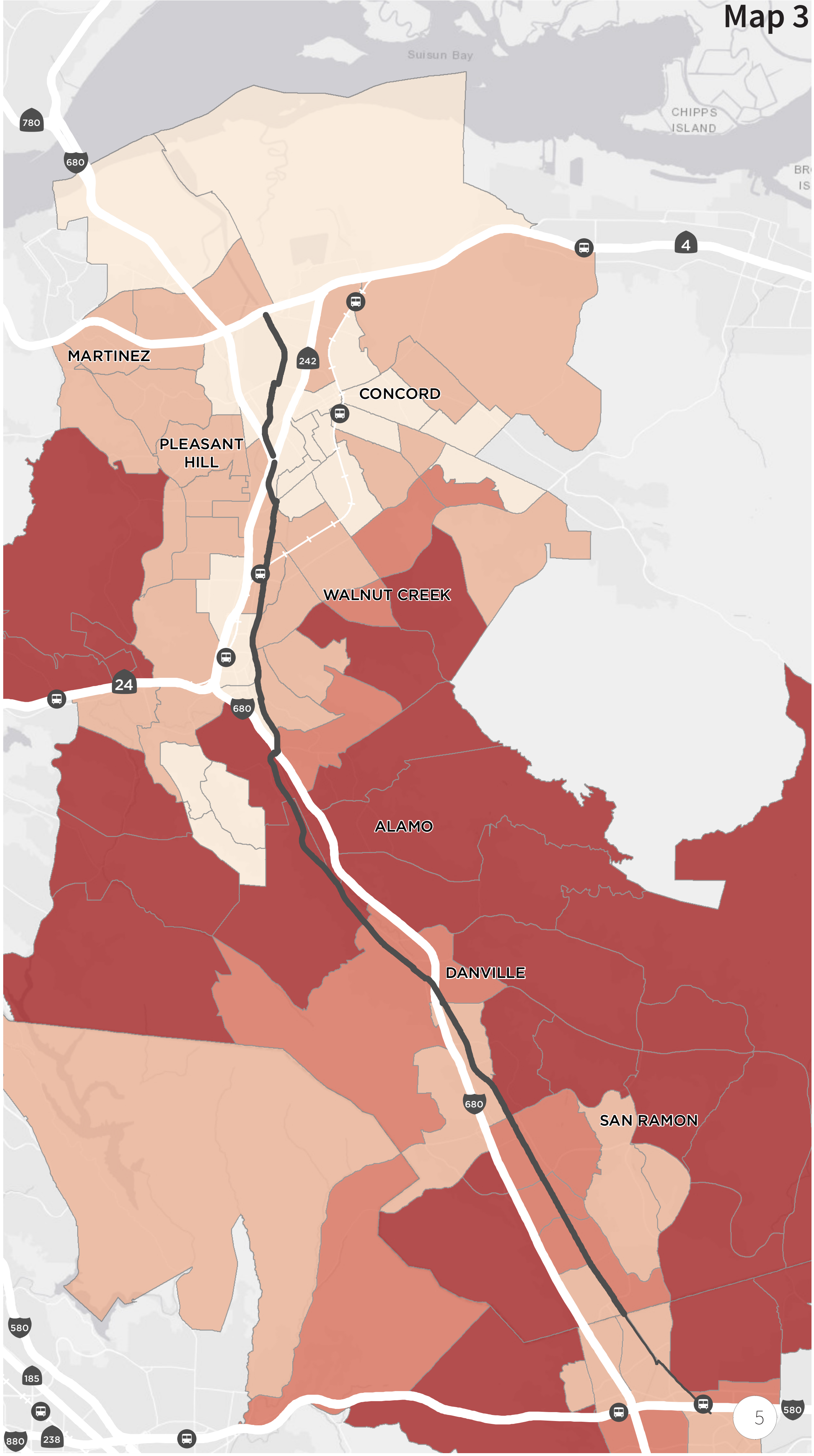
Median Household Income (Census tracts within 3 miles of Iron Horse Trail)

- $28,656 - $80,000
- $80,001 - $120,000
- $120,001 - $140,000
- $140,000 - $205,441

Iron Horse Trail

BART Station

Iron Horse Trail (Alameda County)



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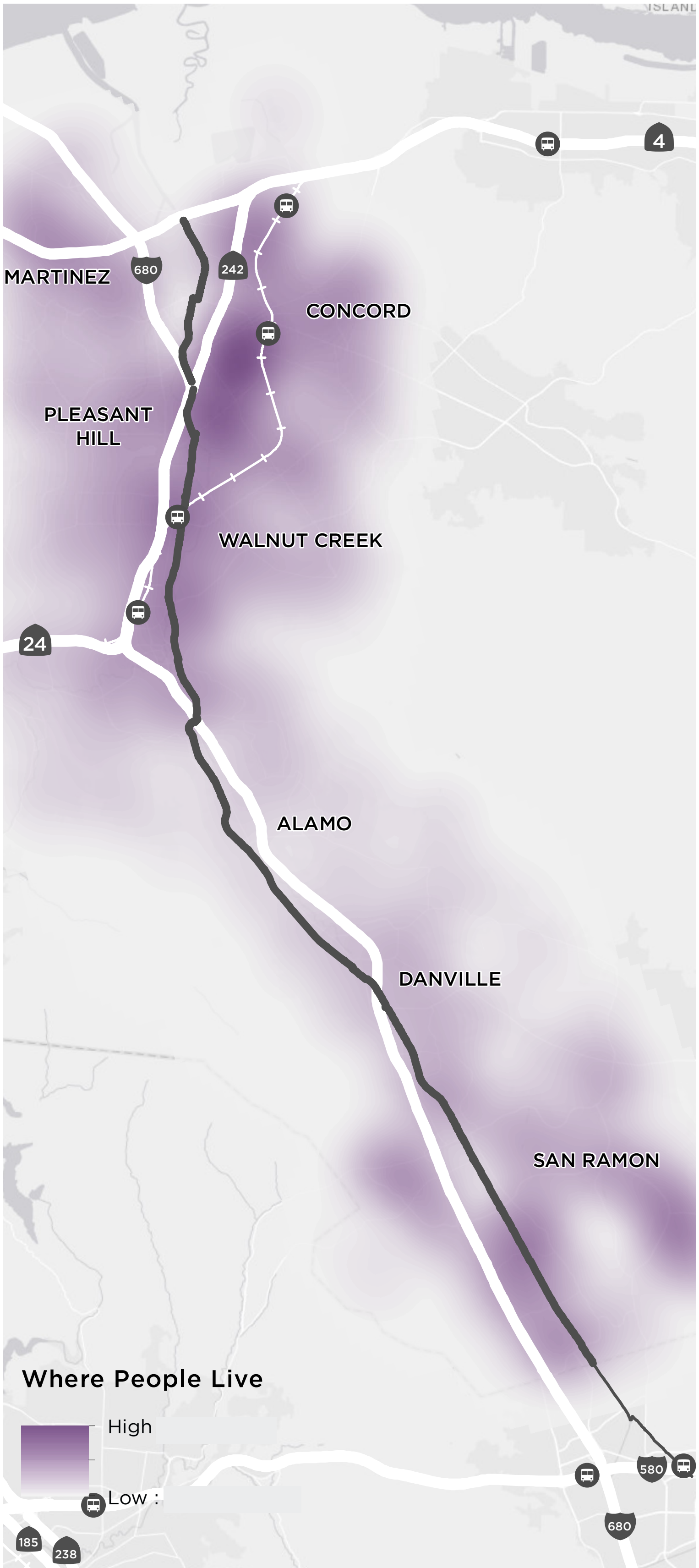
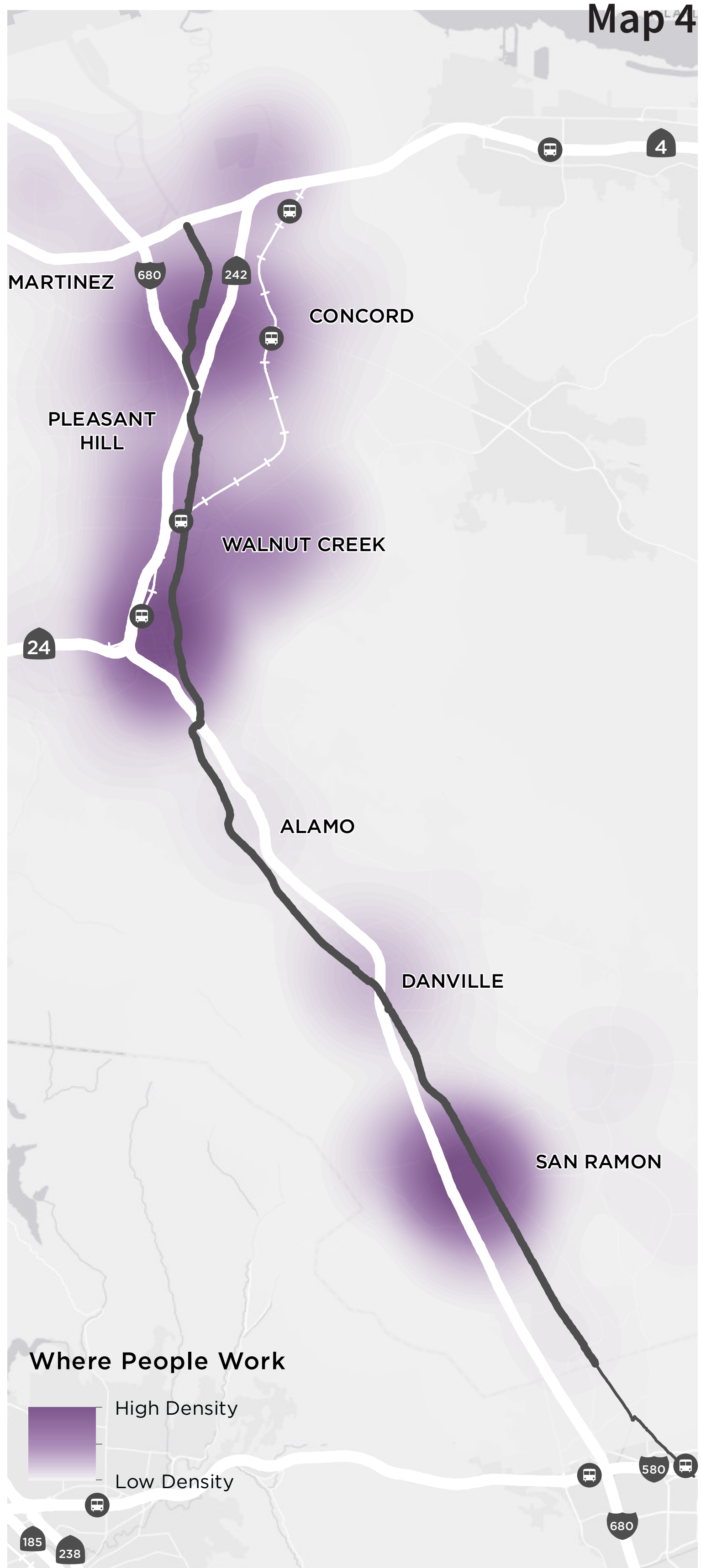
Map produced January 2019.
Sources: U.S. Census, Esri, Contra Costa County, ACS 2016.

Map 4





LIVING AND WORKING NEAR THE IRON HORSE TRAIL

0 1 2 MILES

N

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Iron Horse Trail

BART Station

Iron Horse Trail (Alameda County)

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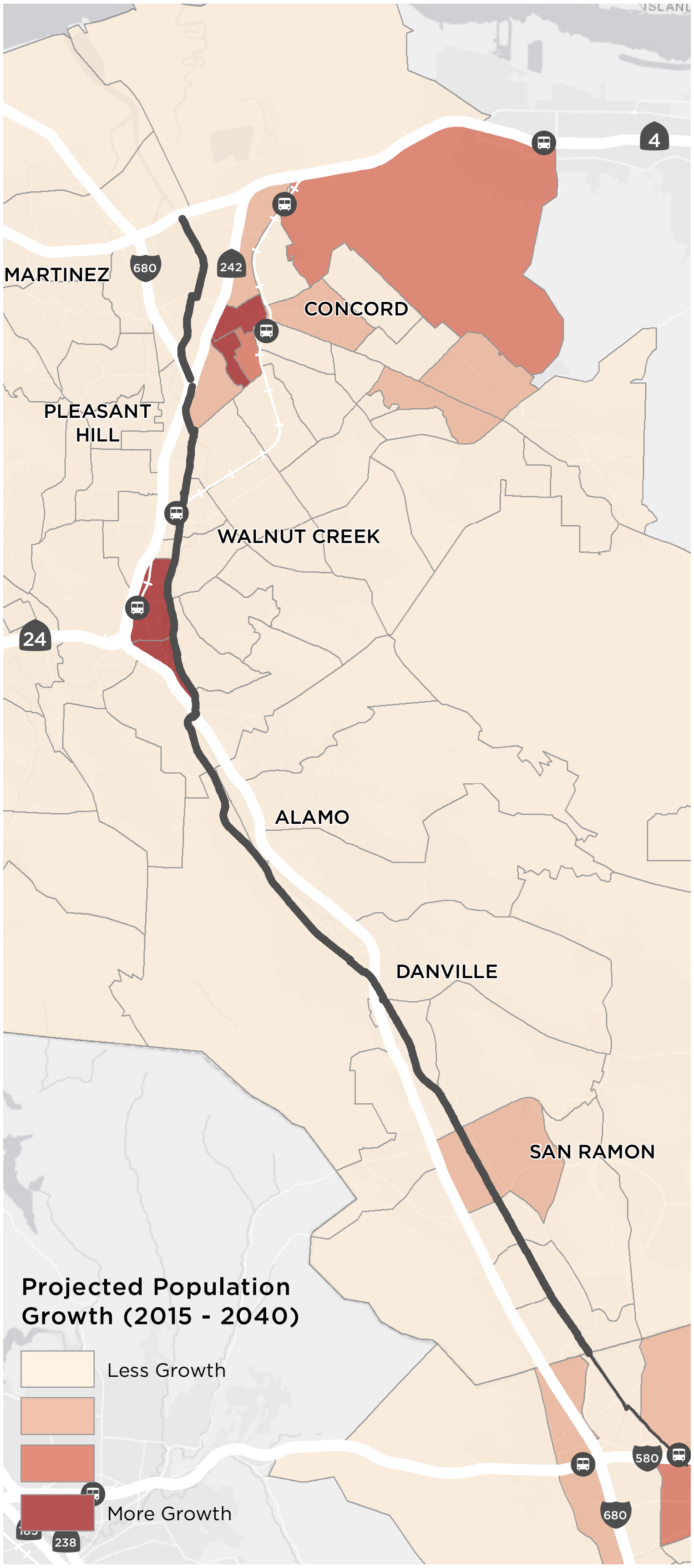
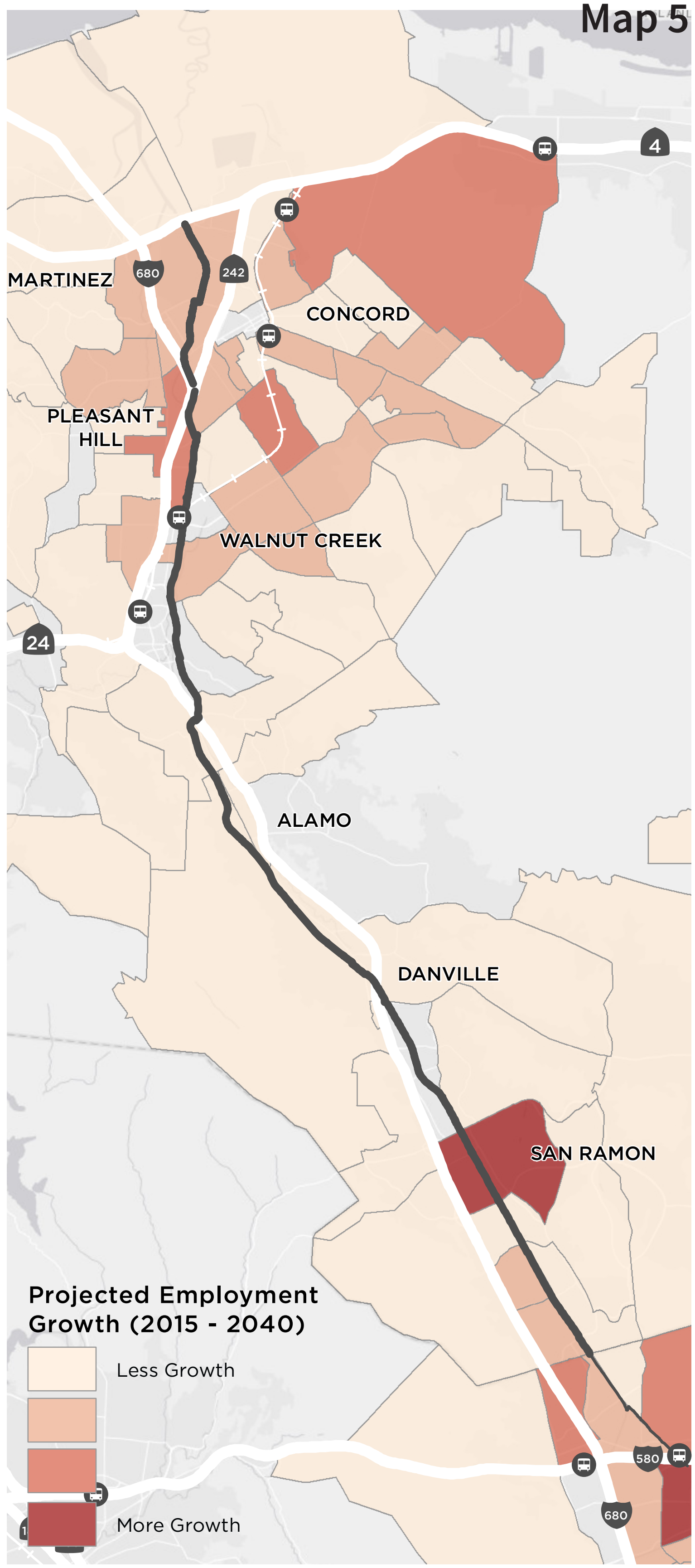
Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OnTheMap.





POPULATION AND EMPLOYMENT GROWTH NEAR THE IRON HORSE TRAIL

CONTRA COSTA COUNTY
IRON HORSE TRAIL

MILES 0 1 2

Iron Horse Trail

BART Station

Iron Horse Trail (Alameda County)

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Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, MTC.

EXISTING NETWORK QUALITY

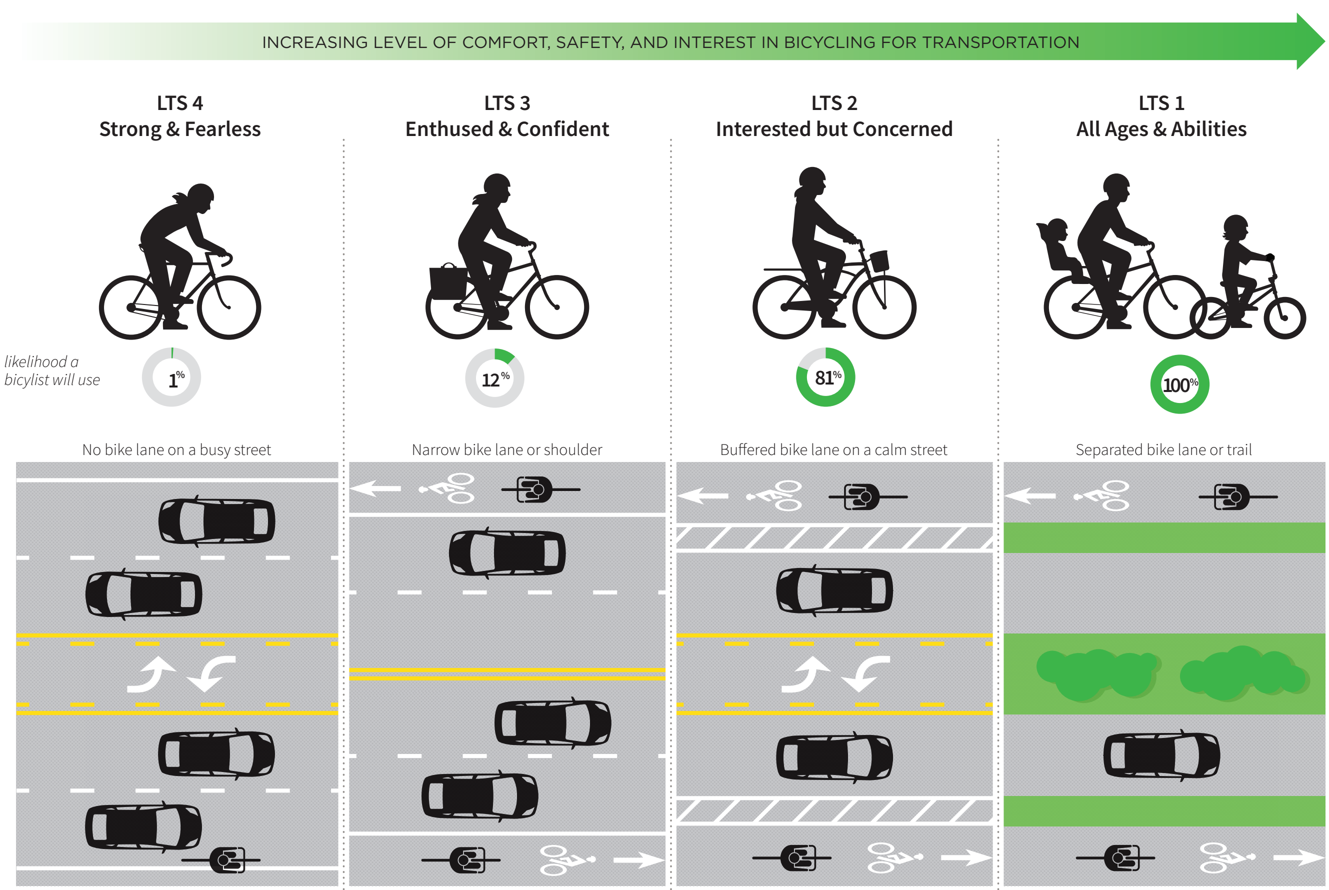
The Iron Horse Trail is a significant bicycling and walking route, but should be considered in the context of walking and bicycling infrastructure in the study area. For the purposes of analyzing how well the Iron Horse Trail supports walking and bicycling today and could support active modes in the future, a level of traffic stress (LTS) evaluation was conducted. LTS is a metric that relates the type and experience of different users to the type of bicycle facility provided (see graphic below). LTS 1 facilities (like trails) are comfortable for all users, while LTS 4 facilities (arterial roads with no bicycle accommodation) are comfortable for only the most fearless bicyclists.

For the purpose of this project, each roadway segment was coded for LTS (Map 6). In addition, intersection-level LTS barriers were also identified, specifically capturing the following situations:

- Street type crossed - arterials, collectors, and local roads
- Intersection control - no control, 2-way stop, all way stop, signalized, flashing beacon

Notably, there are many significant barriers on streets surrounding the Iron Horse Trail and on the roads the trail and many local streets cross. While the Iron Horse Trail, other trails, and local streets provide opportunities for comfortable walking and bicycling, most of these are isolated from one another.

LEVEL OF TRAFFIC STRESS



LEVEL OF TRAFFIC STRESS NEAR IRON HORSE TRAIL

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Level of Traffic Stress

Level 1 Trail (All Ages)

Level 1 Residential (All Ages)

Level 2 (Average Adult)

Level 3 (Confidant Adult)

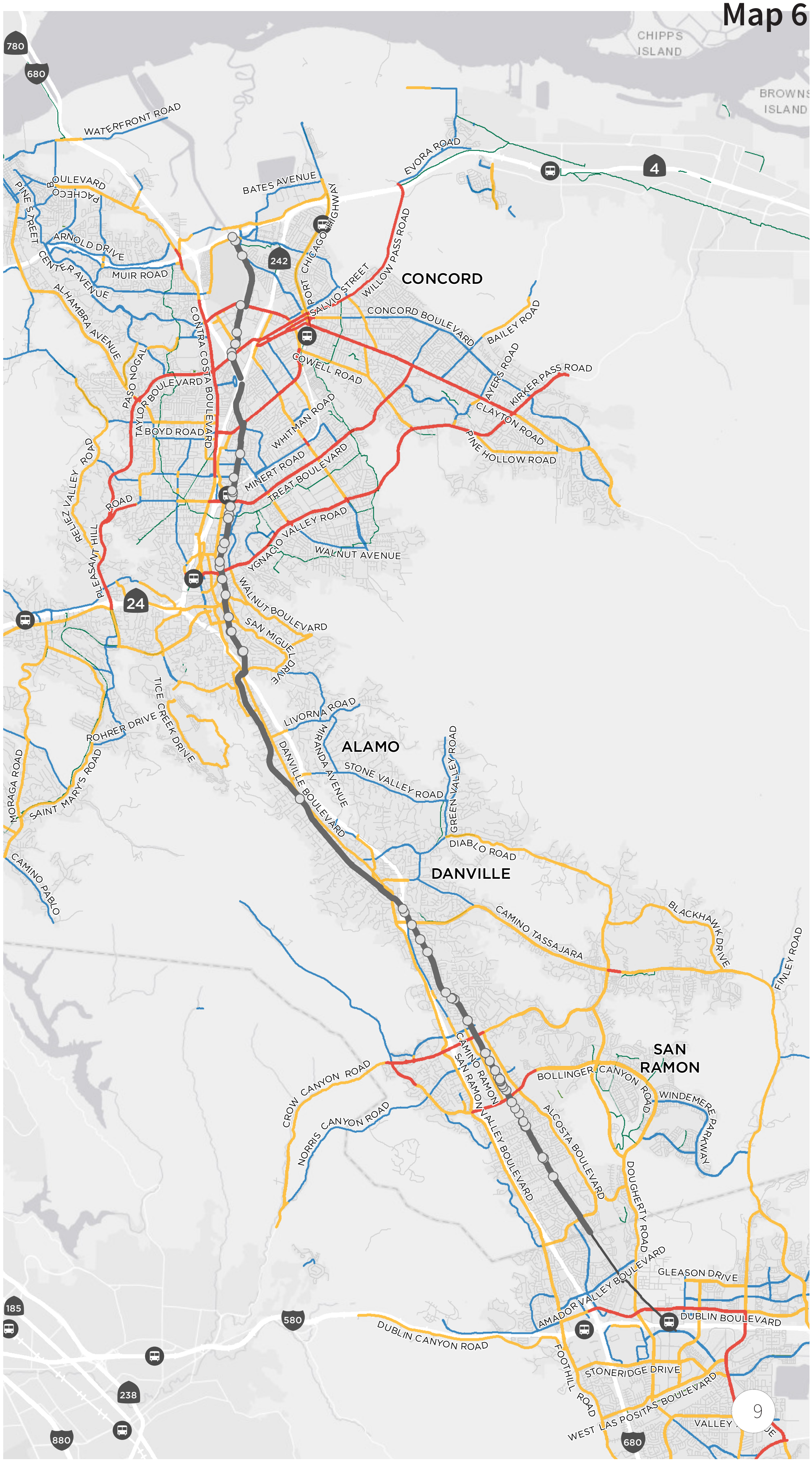
Level 4 (Fearless Adult)

IHT Access Point

Iron Horse Trail

BART Station

Iron Horse Trail (Alameda County)



0 1 2 MILES

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PLANNING + DESIGN

Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OSM.

DESTINATIONS

The Iron Horse Trail connects many destinations in the five cities and unincorporated County land along the corridor. To help set a baseline for access to various types of destinations, the following maps capture accessibility to select destinations using only low stress (LTS 1 and 2) routes, including the Iron Horse Trail. In addition, rather than using actual travel distance, these maps use a measure of perceived distance, building on academic research that indicates that people walking and bicycling on high volume and high speed streets perceive their travel to take longer than those on more comfortable and low stress streets. To achieve an estimate of perceived distance, the actual distance traveled is multiplied by a weight that is derived from the LTS score of a segment (see table at the right).

LTS WEIGHTS

LTS	Examples	Weight
1	Trails	0.500
1	Local streets	1.125
2	Bike facilities on low volume streets	2.000
3	Bike facilities on high volume streets	4.500
4	No bike facility	8.000

Low stress access to select destinations include:

- Transit — the Pleasant Hill and Dublin/Pleasanton BART stations directly connect to the trail and other BART stations could be connected in the future. Several bus transit routes also have stops that may provide connections to the Iron Horse Trail. Map 7 identifies low stress access to BART stations and major bus transit or park and ride facilities in each of the communities near the corridor.
- Schools — 17 schools are immediately adjacent to the trail and many others are served by the trail. The Iron Horse Trail provides connectivity for 24 public schools that have catchment areas that overlap the trail in a significant way. Detailed information about school accessibility by school type is provided on page 15.
- Parks — 8 parks are within 1,000 feet of the trail and an additional 9 parks are within a 1/2 mile of the trail. Map 8 shows low stress accessibility to parks that are within a quarter mile of the trail and several regional parks or major open space areas.
- Employment centers — areas like Bishop Ranch in San Ramon (600 companies and growing, with approximately 25,000 employees) and Contra Costa Centre Transit Village in Walnut Creek (over 6,000 employees) are well served by the trail as are many smaller employment areas in the region. Map 9 identifies accessibility to major employment centers and downtowns near the trail.
- Commercial areas — the trail crosses through downtown San Ramon, Danville, and unincorporated Alamo. The Contra Costa Canal Trail provides a connection to downtown Pleasant Hill and connections could be made to downtown Concord and Walnut Creek. Several shopping centers lie directly adjacent to or within a short distance of the trail, providing access to services, retail business, and other similar opportunities. Map 10 identifies low stress access to these shopping areas near the trail.

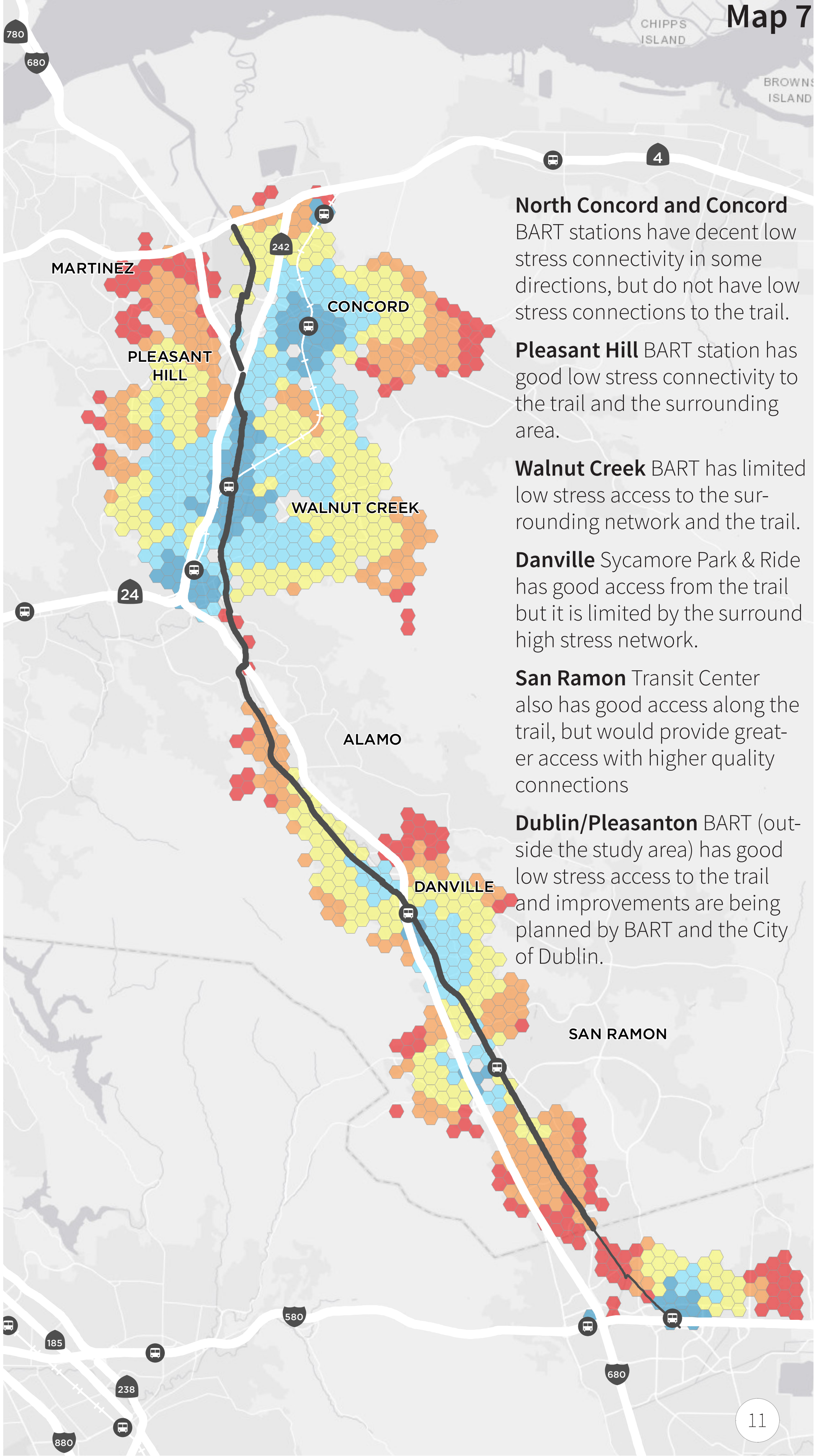
Note that the maps show access to destinations regardless of whether the Iron Horse Trail is used for part of the journey. Future analysis will be compared to this basis to identify how improvements to the trail can improve accessibility and connectivity for residents and visitors wishing to travel using active transportation modes. The analysis also only considers formal trail access points, so access may look poor in areas near the trail that have informal connections.

TRANSIT ACCESSIBILITY

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Transit Access Along Low Stress Network

- Transit
- 0 - 1 Mile
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5 Miles



North Concord and Concord BART stations have decent low stress connectivity in some directions, but do not have low stress connections to the trail.

Pleasant Hill BART station has good low stress connectivity to the trail and the surrounding area.

Walnut Creek BART has limited low stress access to the surrounding network and the trail.

Danville Sycamore Park & Ride has good access from the trail but it is limited by the surround high stress network.

San Ramon Transit Center also has good access along the trail, but would provide greater access with higher quality connections

Dublin/Pleasanton BART (outside the study area) has good low stress access to the trail and improvements are being planned by BART and the City of Dublin.

- Iron Horse Trail
- Transit Access
- Iron Horse Trail (Alameda County)

MILES
0 1 2

N

alta
PLANNING + DESIGN

Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OSM.

PARK ACCESSIBILITY

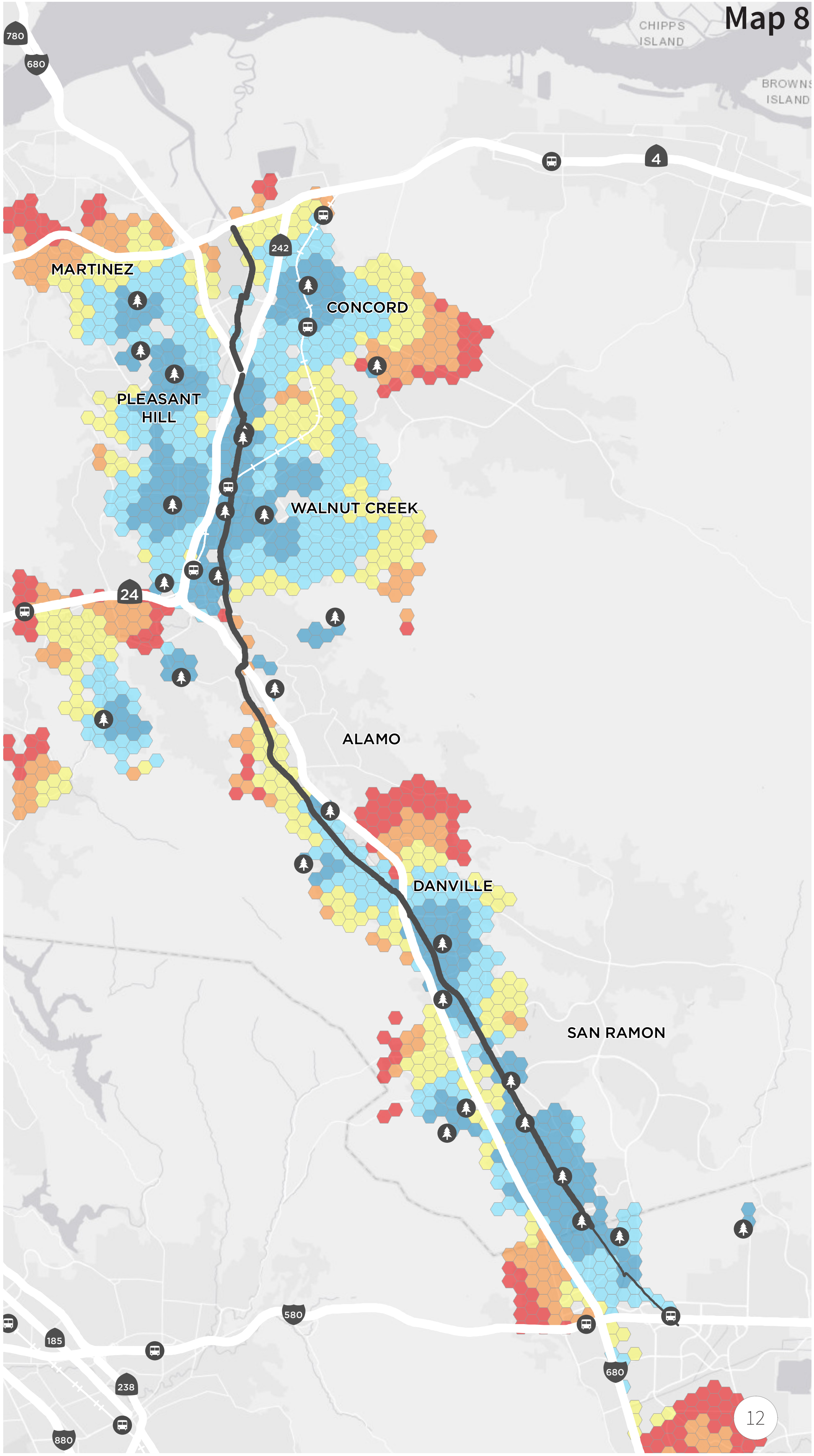
CONTRA COSTA COUNTY
IRON HORSE TRAIL

Park Access Along Low Stress Network

- Park
- 0 -1 Mile
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5 Miles

- Iron Horse Trail
- BART Station
- Iron Horse Trail (Alameda County)

MILES 0 1 2



Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OSM.

OFFICE ACCESSIBILITY

CONTRA COSTA COUNTY
IRON HORSE TRAIL

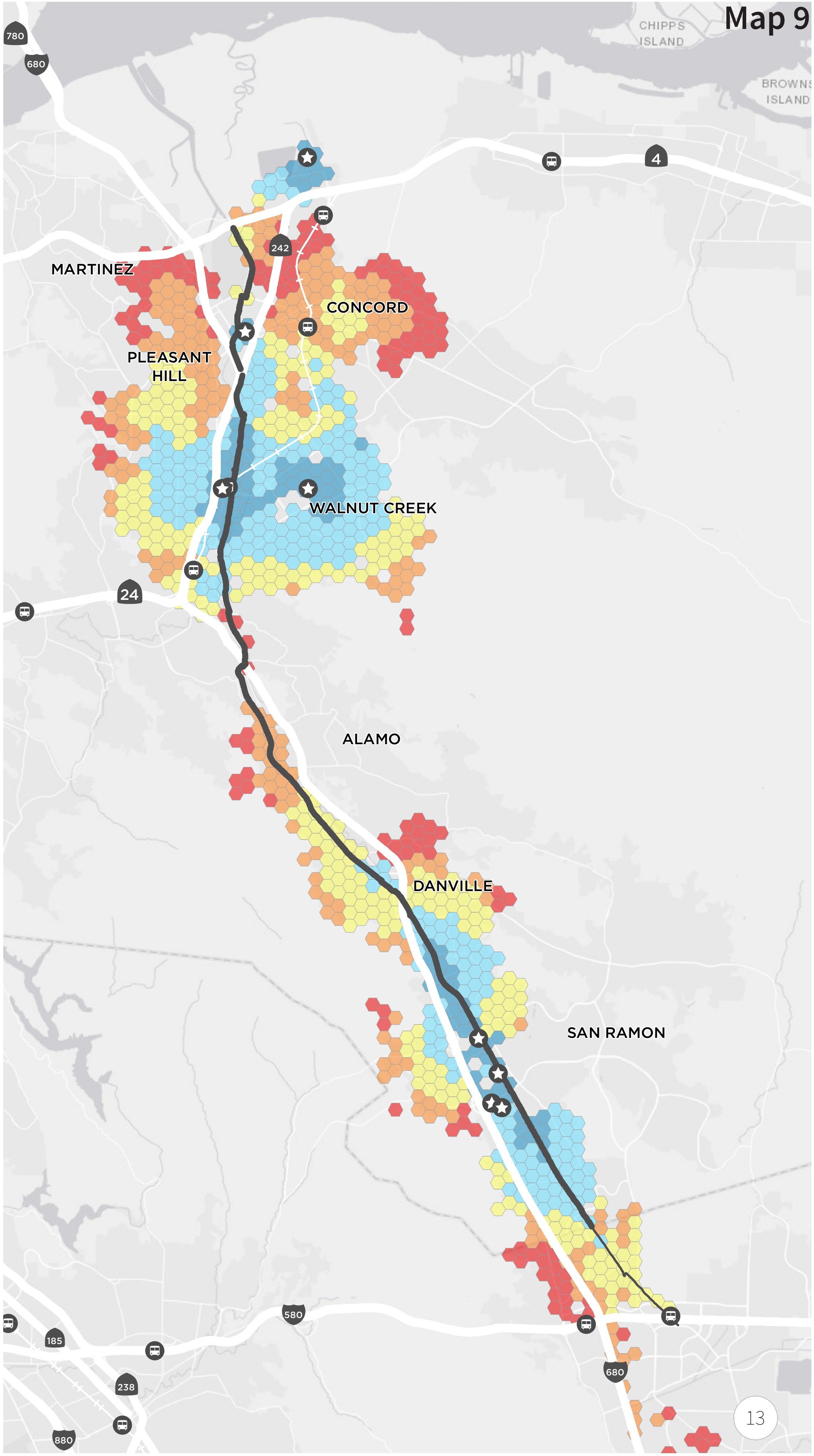
Accessibility to Nearest Office Along Low Stress Network

- Office
- 0 -1 Mile
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5 Miles

- Iron Horse Trail
- BART Station
- Iron Horse Trail (Alameda County)

MILES
0 1 2

N



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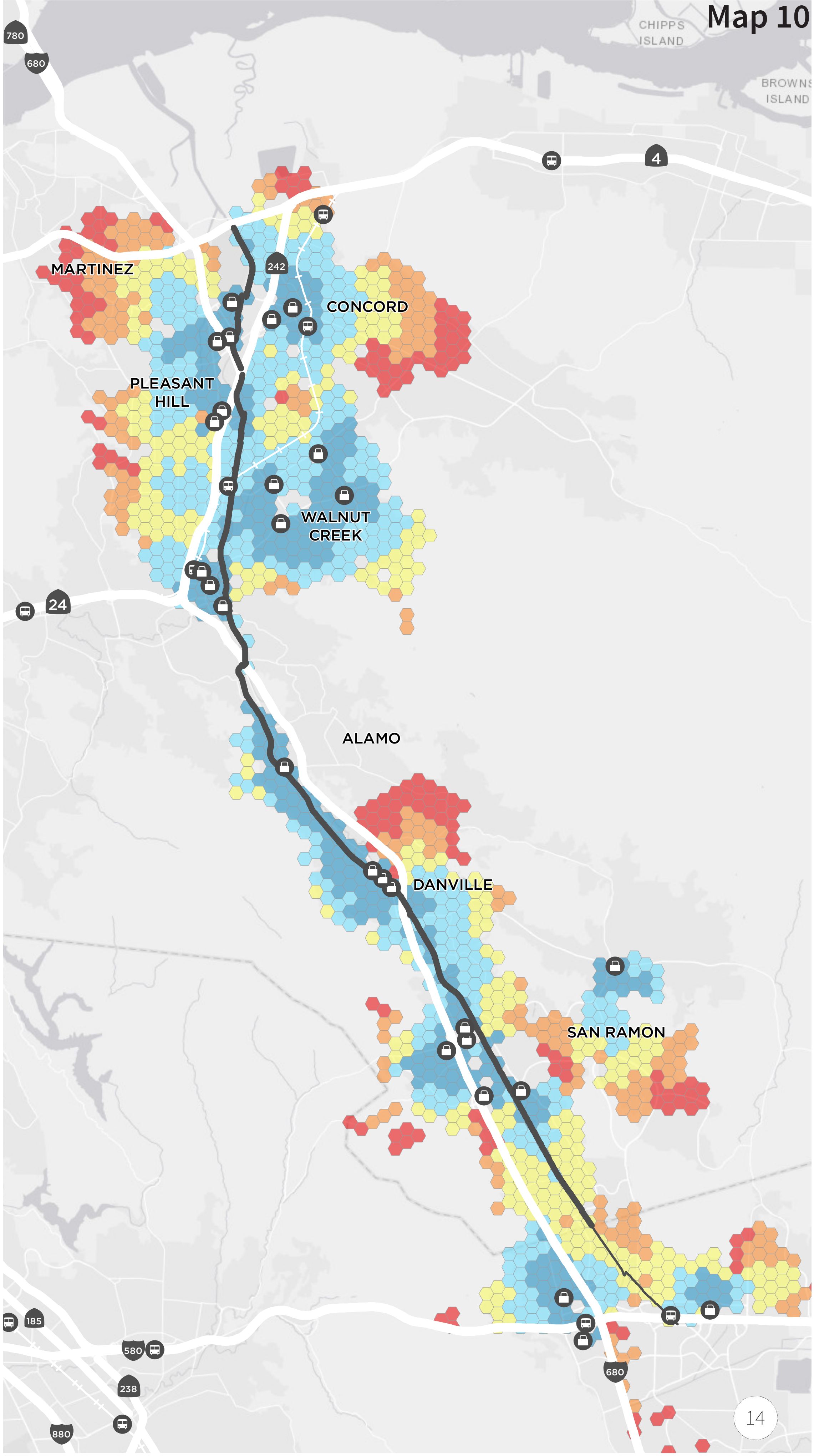
Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OSM.

SHOPPING ACCESSIBILITY

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Accessibility to Nearest Shopping Center Along Low Stress Network

- Shopping Center
- 0 -1 Mile
- 1 -2
- 2 - 3
- 3 - 4
- 4 - 5 Miles



- Iron Horse Trail
- BART Station
- Iron Horse Trail (Alameda County)

0 1 2 MILES

N

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Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OSM.

SCHOOLS

Three maps provide more detail about accessibility to schools in the Iron Horse Trail corridor, one each for elementary schools (Map 11), middle schools (Map 12) and high schools (Map 13). Each map uses the current catchment areas for these schools, recognizing that intraschool and intradistrict transfers often occur and that school catchment areas change over time. These maps show only low stress accessibility, or facilities that are comfortable for most people to use.

Elementary School Accessibility. There are eight elementary schools located directly adjacent to the Iron Horse Trail and another five schools with catchment areas that substantially overlap the trail. Elementary schools have generally smaller enrollment areas and the color ramp used in Map 11 is different from the others to reflect the different break points for the map. The Iron Horse Trail generally supports low stress accessibility for most schools immediately adjacent to it, with the exception of Walnut Heights Elementary in Walnut Creek, Murwood Elementary in Danville, and Montevideo Elementary in San Ramon, for which walking access is constrained by other, high-stress streets.

Middle School Accessibility. Two middle schools are directly adjacent to the trail and another four have catchment areas that directly overlap the trail (Map 12). While adjacent to the trail, Iron Horse Middle School in San Ramon currently has a catchment area that largely extends beyond the reach of the trail. For Walnut Creek Intermediate, the trail provides excellent connectivity to a portion of the surrounding student population, though high stress streets make access uncomfortable for many students. For two middle schools—Oak Grove in Concord and Stone Valley in Alamo—the trail does not substantially connect students to school, though improved connections to the trail could provide some additional benefits.

High School Accessibility. There are three high schools (California, San Ramon Valley, and Las Lomas) that are immediately adjacent to the trail and two others (Ygnacio Valley and Mt. Diablo) that have catchment areas that overlap the trail. High schools generally have the largest catchment areas, but also the most mobile attendees, making trail-based connectivity a real possibility for many students. Students of San Ramon Valley High and California High benefit from low stress access provided by the trail, while the trail provides limited benefit to students at Las Lomas High. Map 13 shows how the trail expands accessibility for students by providing an additional low stress network.

ELEMENTARY SCHOOL ACCESSIBILITY

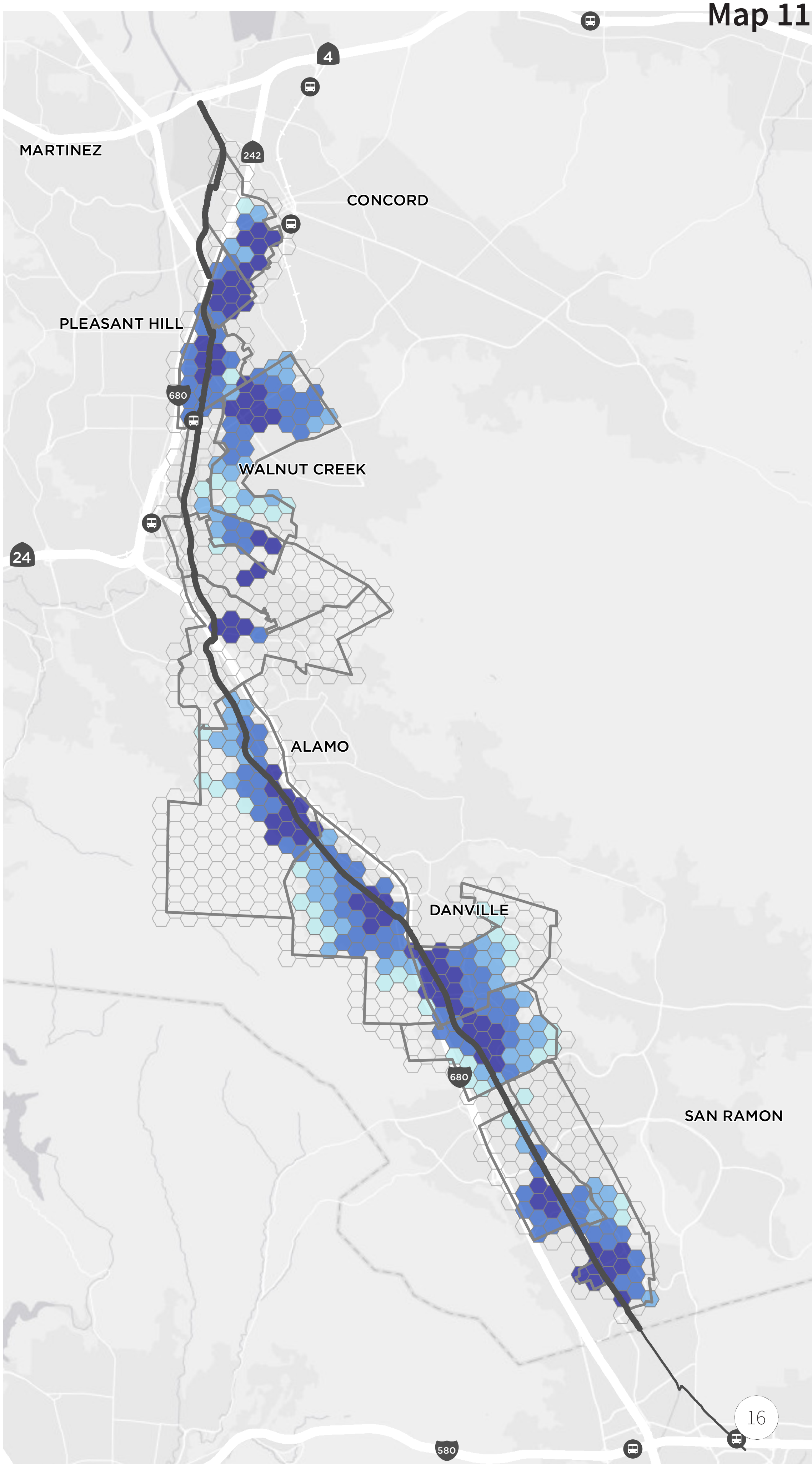
CONTRA COSTA COUNTY
IRON HORSE TRAIL

Elementary School Accessibility Along Low Stress Network

0 - .5 Miles
.5 - 1
1 - 1.5
1.5 - 2 Miles
Not Accessible on Low Stress Network

Elementary School
School Attendance Boundary

Map 11



Iron Horse Trail
BART Station
Iron Horse Trail (Alameda County)

0 1 2 MILES

N

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Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OSM.

MIDDLE SCHOOL ACCESSIBILITY

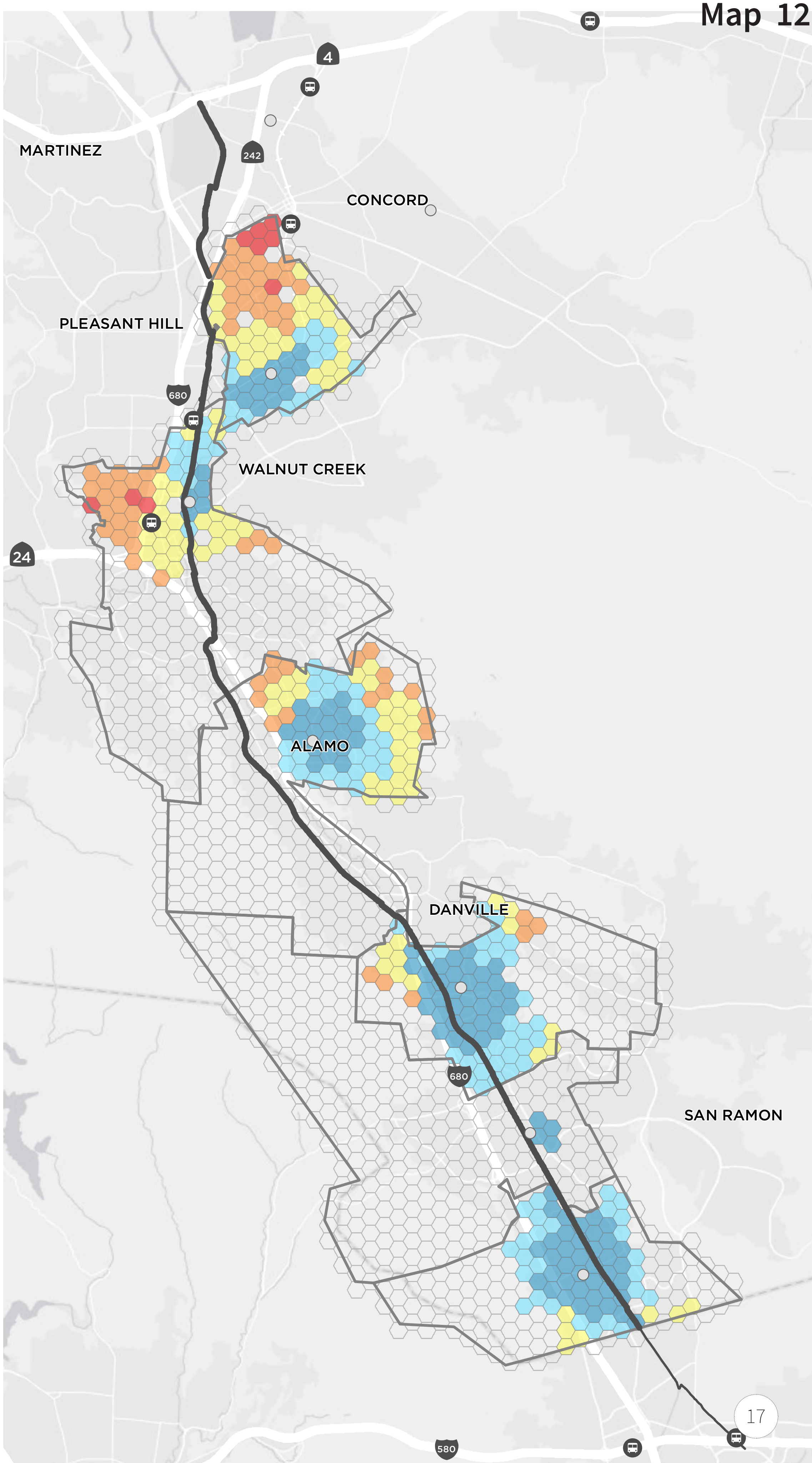
CONTRA COSTA COUNTY
IRON HORSE TRAIL

Middle School Accessibility Along Low Stress Network

- 0 - 1 Mile
- 1 -2
- 2 - 3
- 3 - 4
- 4 - 5 Miles
- Not Accessible on Low Stress Network

- Middle School
- School Attendance Boundary

- Iron Horse Trail
- BART Station
- Iron Horse Trail (Alameda County)



Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OSM.

Map 13

HIGH SCHOOL ACCESSIBILITY

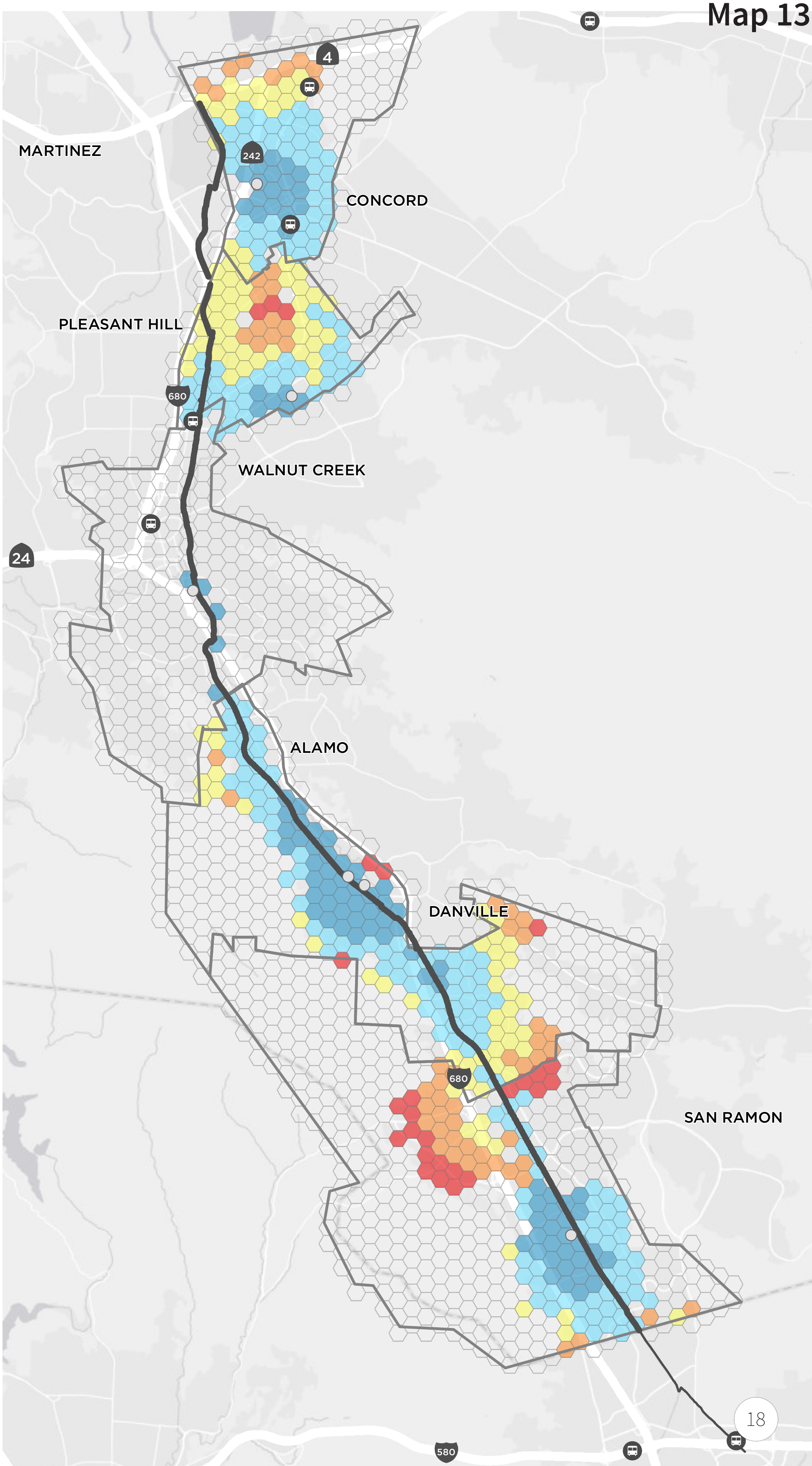
CONTRA COSTA COUNTY
IRON HORSE TRAIL

High School Accessibility Along Low Stress Network

0 - 1 Mile
1 -2
2 - 3
3 - 4
4 - 5 Miles
Not Accessible on Low Stress Network

High School
School Attendance Boundary

Iron Horse Trail
BART Station
Iron Horse Trail (Alameda County)



0 1 2 MILES

N

alta
PLANNING + DESIGN

Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OSM.

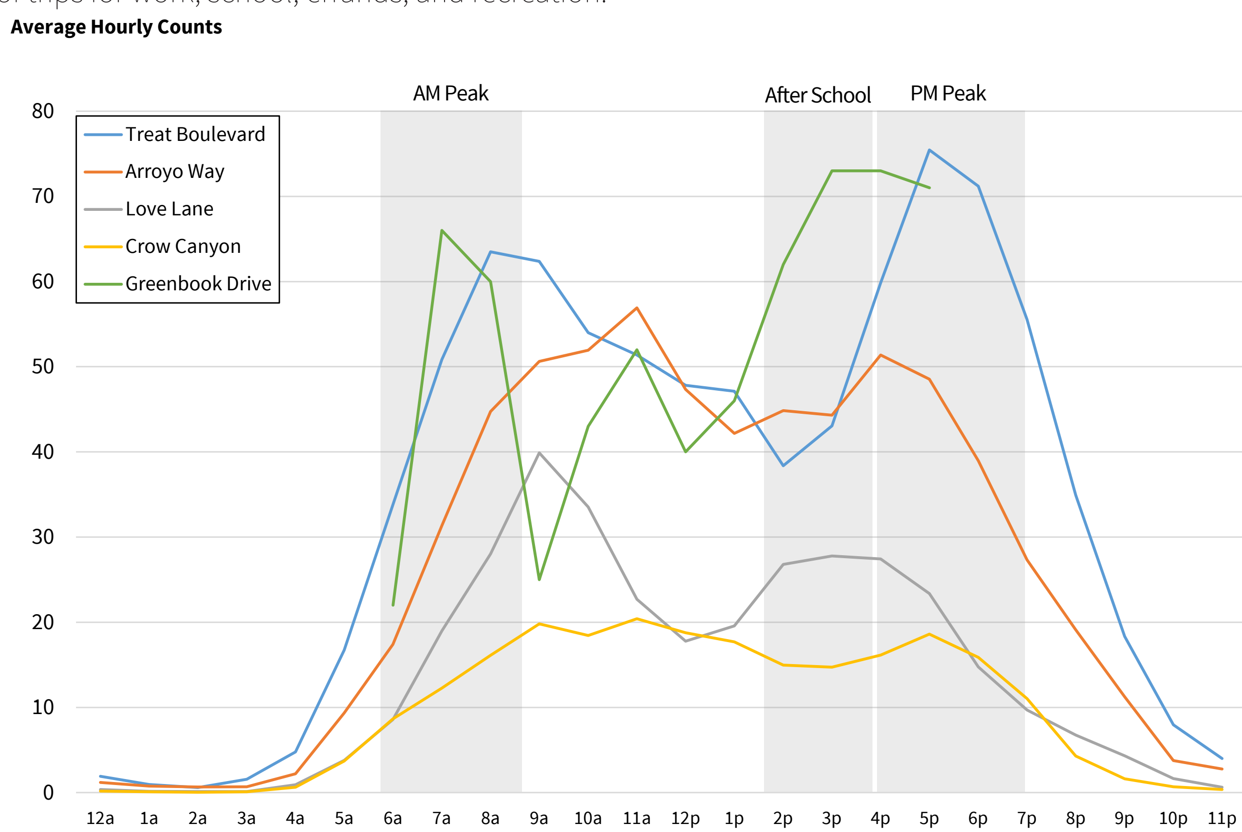
USE OF THE IRON HORSE TRAIL TODAY

The Iron Horse Trail is heavily used today for both utilitarian and recreational purposes. The variety of destinations contributes to its multiple uses and the length and beauty of many segments of the trail attract recreational riders. To support planning for the future of the Iron Horse Trail, we consider how it is used from several perspectives, including actual numbers of users, users on crossing roads, and potential demand for the trail (i.e., people who could use the trail to access their destinations).

CURRENT USE OF THE TRAIL

The East Bay Regional Park District (EBRPD) took counts at four locations along the trail in the fall of 2017. Counts were also available at a fifth location in Danville from the fall of 2018. Map 14 presents these five counts for an average weekday (Tuesday, Wednesday, Thursday) and an average weekend day (Saturday, Sunday). The highest weekday use was near Treat Boulevard (nearly 900 users) and the lowest at Crow Canyon (239 users). Week-end counts were higher near Danville (over 900 users) and in Walnut Creek (over 730 users at Treat Boulevard and Arroyo Way). There were lower weekend counts at Love Lane and Crow Canyon Road. These five count locations do not tell the entire story, but help capture some of the current variance in use.

Variations in travel by hour and location for weekday trips are provided in the figure below. Counts at Treat Boulevard show typical AM and PM peaks, while Love Lane—adjacent to the San Ramon Valley High School—shows travel more typical of school schedules. Arroyo Way and Crow Canyon show more balanced trips during the day, suggesting use for a mix of trips for work, school, errands, and recreation.



ON-TRAIL COUNTS

CONTRA COSTA COUNTY
IRON HORSE TRAIL

On-Trail Counts

Weekday Average Daily Count

Weekend Average Daily Count

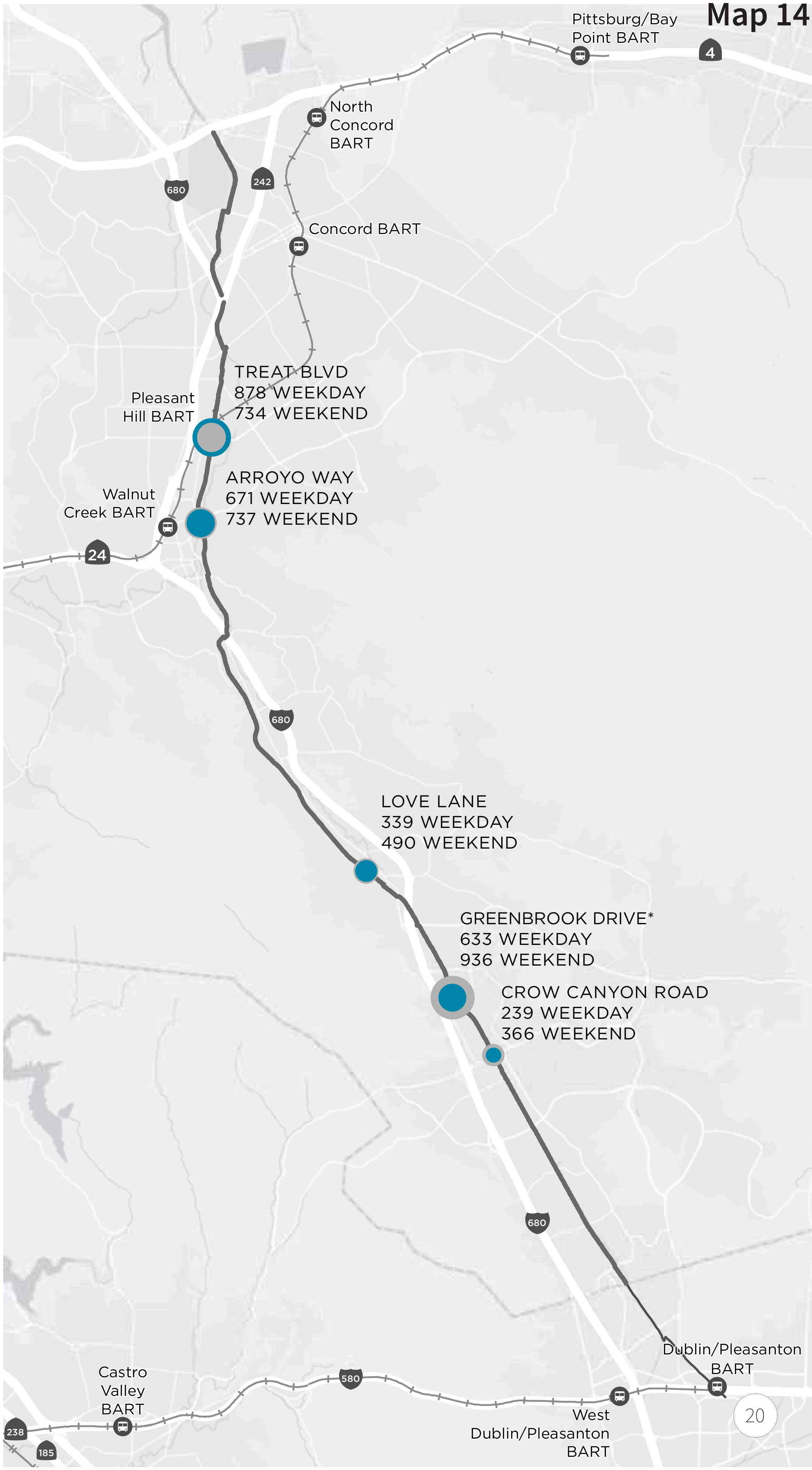
Iron Horse Trail

BART Station

Iron Horse Trail (Alameda County)

*Note: Greenbrook Drive counts were taken in Fall of 2018. Remaining counts were taken in the Fall of 2017.

MILES
0 1 2



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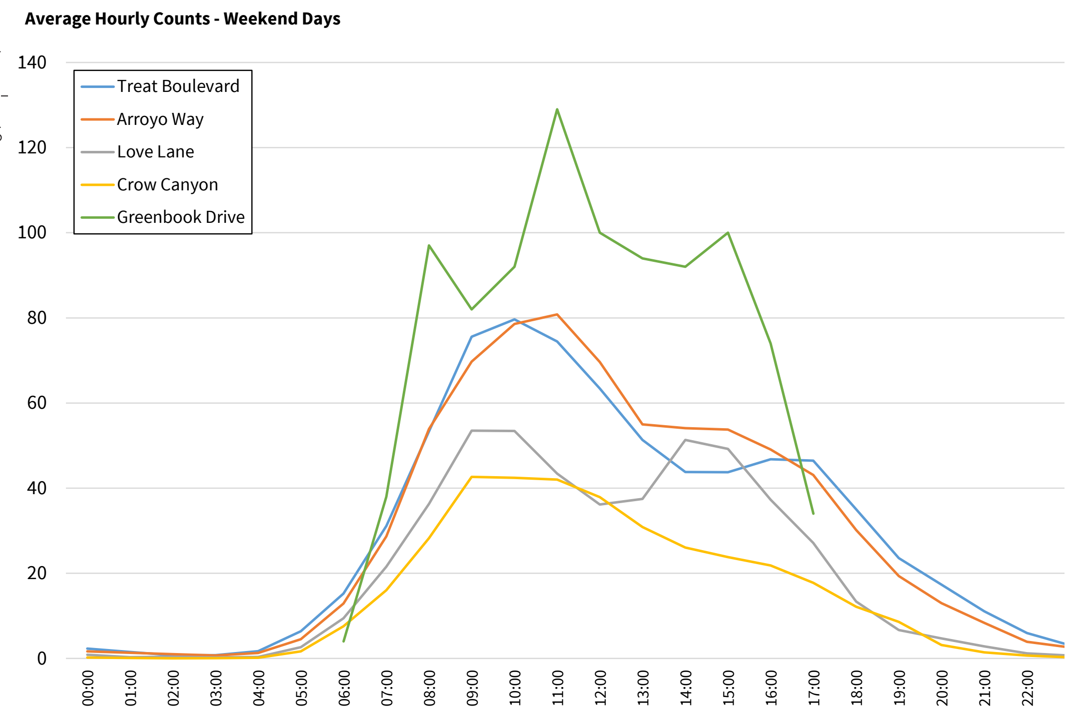
Map produced February 2019. Sources: U.S. Census, Esri, Contra Costa County. EBPRD.

The chart at the right presents the same information for weekend trips, showing a generally common pattern across all count sites, with peaks generally in the late morning.



The Contra Costa Transportation Authority (CCTA) also provides information about pedestrians and bicyclists traveling on nearby streets (Map 15). Available counts from CCTA were clustered in the northern cities of the study area and are shown separately for bicyclists and pedestrians. Pedestrian counts were more substantial than bicycle counts and were concentrated, as expected, around BART stations and near downtowns. Bicycle counts were higher near the Iron Horse Trail. Only peak period counts are available on street.

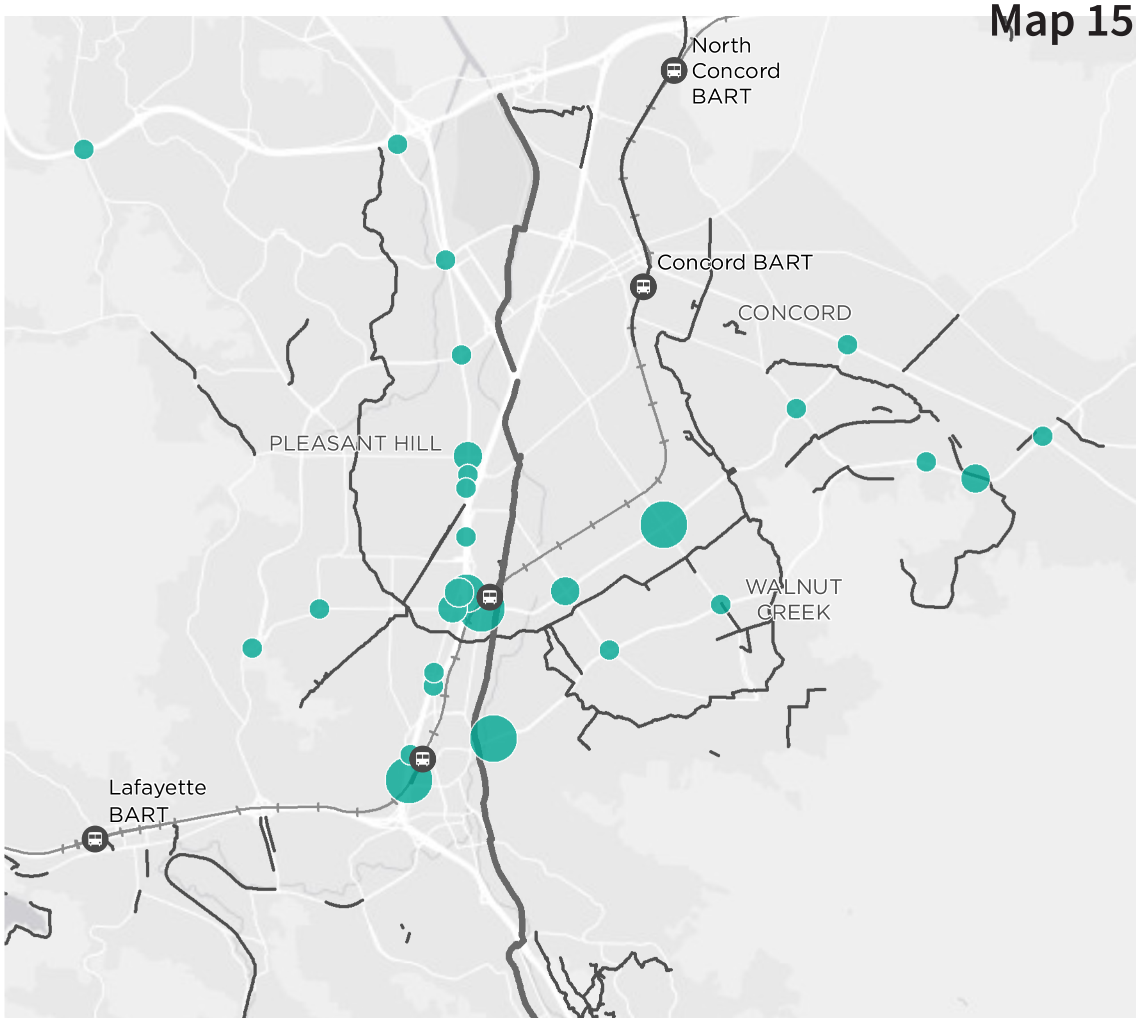
POTENTIAL USE OF THE TRAIL

While counts tell part of the story of the use of the Iron Horse Trail, a critical question for this study is how much demand there is to use the trail. Using data from the CCTA Travel Demand Model, growth in potential bicycle and pedestrian trips was identified for each zone by calculating the number of short distance trips—those that end within the same zone or in zones within a half mile buffer of the origin for both 2015 and 2040. Map 16 presents the change from 2015 to 2040 in these short distance trips.

Zones along the trail between Walnut Creek and Concord are expected to have even more demand for short, active transportation-length trips than today. These are the same areas with low car ownership rates, high walk/bike commute rates, and low median household incomes (see Maps 1 through 3).

COUNTS

CONTRA COSTA COUNTY
IRON HORSE TRAIL



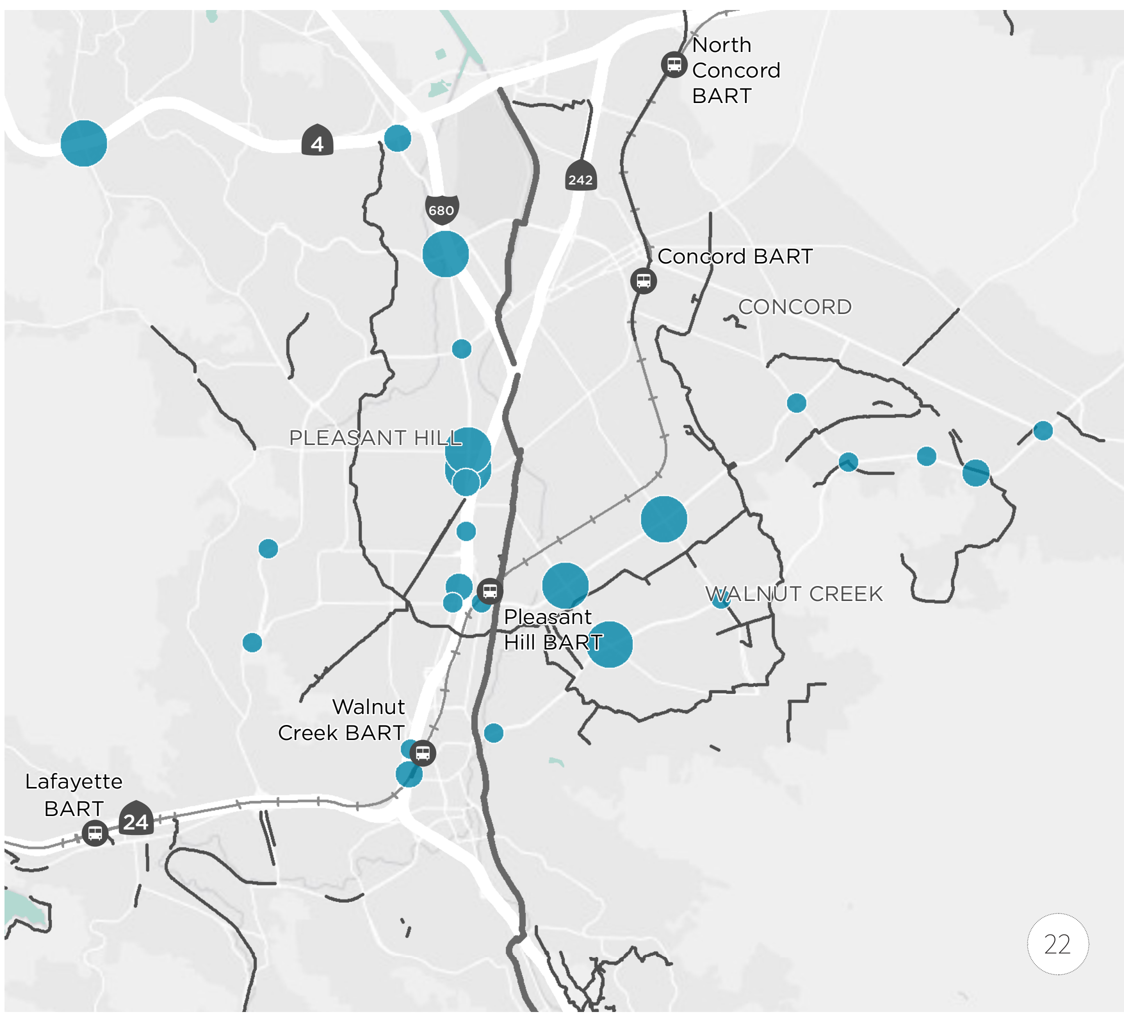
Pedestrian AM Peak 1-Hour Counts (2017)

1 - 20

21 - 60

61 - 120

121 - 200



Bicycle AM Peak 1-Hour Counts (2017)

1 - 2

3 - 4

5 - 10

Iron Horse Trail

BART Station

Class I Shared-Use Path

0 1 2 MILES

N

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Map produced January 2019.
Sources: U.S. Census, Esri, Contra Costa County, CCTA.

Map 16

EXPECTED INCREASE IN TRIPS

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Growth in Density of Short Distance Trips by CCTA TAZ (2014 to 2040)

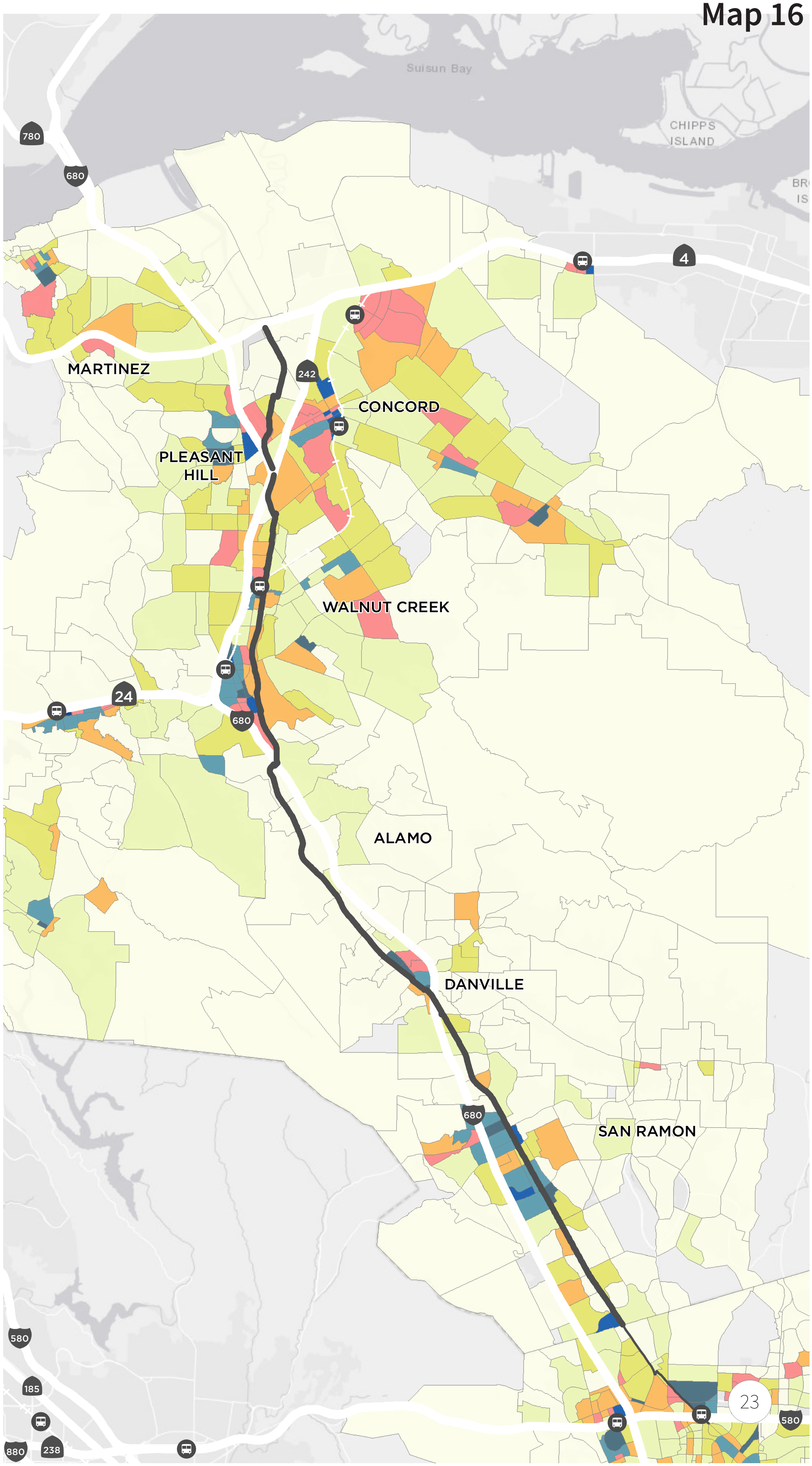
Less Trips

More Trips

Iron Horse Trail

BART Station

Iron Horse Trail (Alameda County)



MILES
0 1 2

Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, CCTA.

SAFETY ON AND ACCESSING THE TRAIL

Creating a high quality active transportation network can address safety challenges that exist in Contra Costa County. The Iron Horse Trail can provide an alternative to nearby high stress routes, many of which experience significant collision rates for people walking and biking.

Maps 17 and 18 present the bicycle and pedestrian collisions and fatalities, respectively, along the Iron Horse Trail. The maps also identify the location of high stress routes as a means to identify how observed safety relates to perceived safety and comfort. Notable hot spots of collisions include Walnut Creek on the west side of I-680 and downtown Concord.

In the 5 most recent years with data available (2013-2017), there were 203 bicycle and pedestrian collisions on local streets within a quarter mile of the trail and 761 within 2 miles. There were 14 bicycle and pedestrian fatalities within 2 miles of the trail. The table at the right identifies the number of bicycle and pedestrian collisions by city and distance from the trail for the five cities and unincorporated areas.

TABLE COLLISIONS

	Miles from Trail				
City	**0.25**	**0.5**	**1**	**2**	**Total**
Concord	35	27	108	87	257
Pleasant Hill	13	2	4	8	27
Walnut Creek	5	50	40	23	118
Danville	30	10	27	14	81
San Ramon	44	4	12	15	75
Unincorporated County	76	67	36	24	203
Total	203	160	227	171	761

Identifying the need for safer crossings and access routes to the Iron Horse Trail is a key goal of this project. Between 2013 and 2017, there were 43 injuries of bicyclists or pedestrians within 100 feet of the trail. Locations with 3 or more bicycle or pedestrian injuries are shown in the table at right, including:

- At Treat Boulevard at Jones Road (11 injuries), a separated crossing was completed prior to the collection of these data, suggesting ongoing safety concerns for individuals accessing the trail.
- Monument Boulevard at Mohr Drive (9 injuries) is a particularly challenging trail crossing, offset from the trail and requiring tight turns for bicyclists.
- South Broadway and Newell Avenue (4 injuries) requires crossing two legs of a busy, wide intersection.
- Hemme Avenue (3 injuries) is a trail crossing of a local road.
- At Sycamore Valley Road and Camino Ramon (3 injuries), trail users must travel slightly away from the trail to cross a wide road.
- At Willow Pass Road (3 injuries), the trail has a separated undercrossing, but also direct access to Willow Pass Road directly adjacent to I-680 on and off ramps.
- Ygnacio Valley Road (3 injuries) also has a separated overcrossing for the trail along with access ramps, indicating potential access concerns.

CROSSING INJURIES

Location	**Injuries**
Treat Blvd & Jones Rd	11
Monument Blvd & Mohr Dr	9
South Broadway & Newell Ave	4
Hemme Ave	3
Sycamore Valley Rd & Camino Ramon	3
Willow Pass Rd	3
Ygnacio Valley Rd	3

BICYCLE COLLISIONS

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Collisions per Hexagon (2013 - 2017)

1 - 3
4 - 7
8 - 14
15 - 25
26 - 44

Fatality

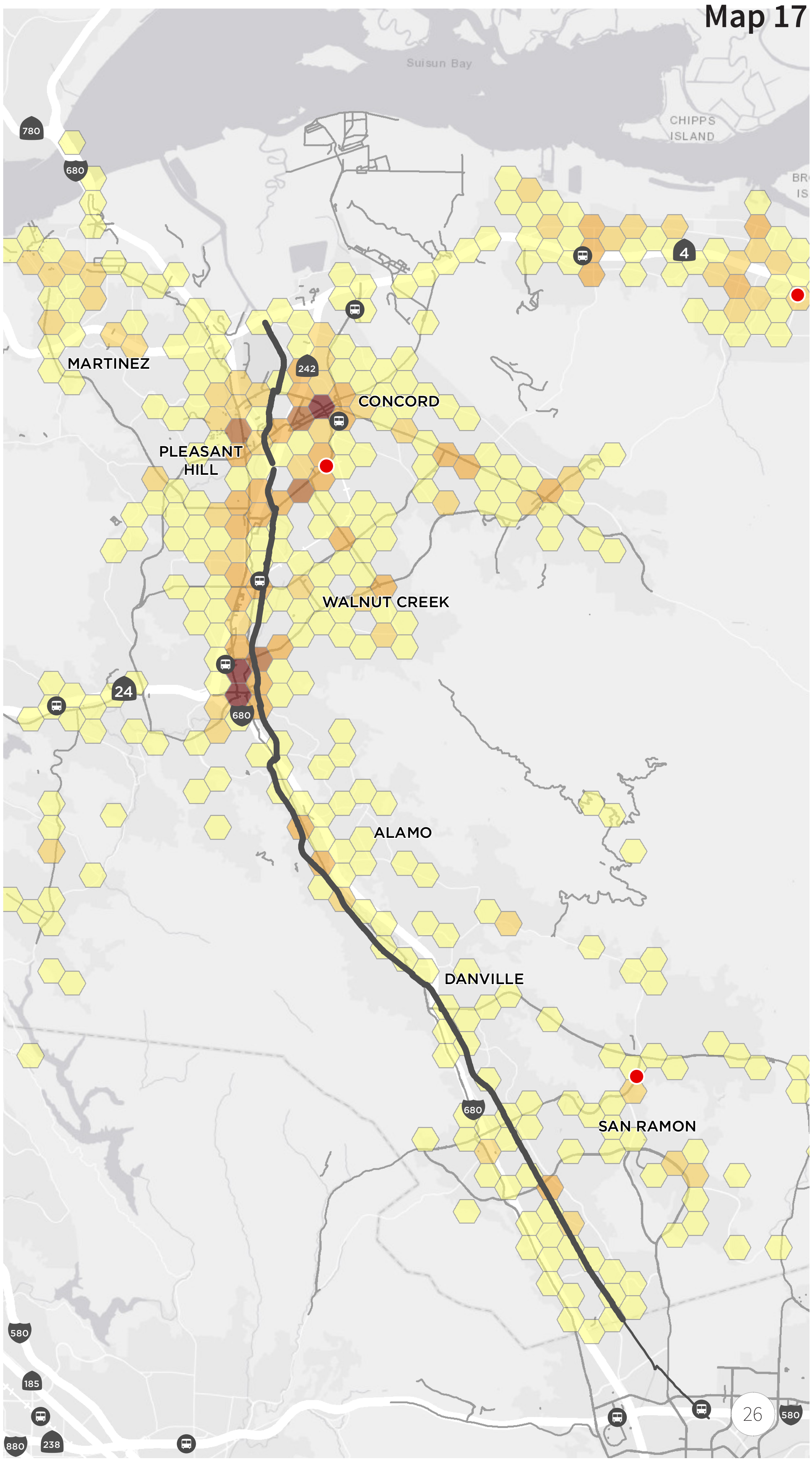
High Stress Roadway

Iron Horse Trail

BART Station

Iron Horse Trail (Alameda County)

MILES
0 1 2



Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, TIMS UC Berkeley.

PEDESTRIAN COLLISIONS

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Collisions per Hexagon (2013 - 2017)

	1 - 2
	2 - 4
	5 - 8
	9 - 14
	15 - 24

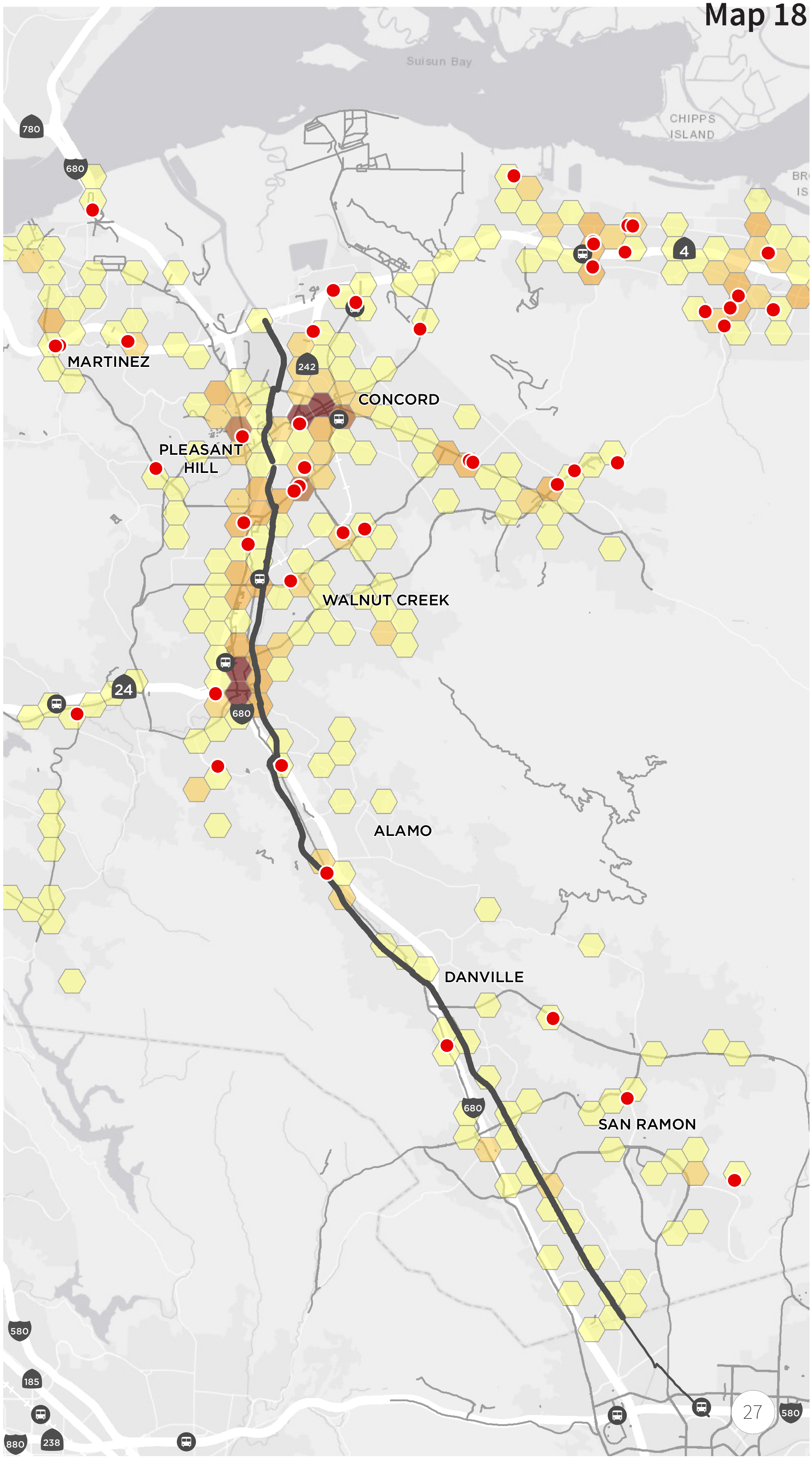
Fatality

High Stress Roadway

Iron Horse Trail

BART Station

Iron Horse Trail (Alameda County)



0 1 2 MILES

N

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Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, TIMS UC Berkeley.

CONNECTIVITY TO THE IRON HORSE TRAIL

One of the critical questions this study seeks to address is how to increase trips along the Iron Horse Trail corridor using active modes. Combining information from the prior sections, this section provides a baseline of information about trail connectivity and describes the next steps in this analysis.

Map 19 summarizes connectivity to existing Iron Horse Trail access points considering the comfort of existing routes. Representative distances have been applied to each mode to help describe how users across the study area might access the trail. Less than half a mile to the trail is identified as walking distance, 0.5 to 3 miles is considered biking distance, and 3 - 10 miles is considered e-biking distance. As above, distances are weighted by the level of traffic stress of the streets and paths used to access the trail.

Using this analysis, only 35% of people who live in the study area are currently within comfortable walking and biking distance of the trail. In many cases, major arterials and I-680 provide significant barriers for those attempting to access the trail.

Looking forward, the next phase of the study will start to address the question of how many active transportation trips are possible with additional investment. This analysis will consider:

- The comfort and convenience of the Iron Horse Trail
- The comfort, convenience, and safety of Iron Horse Trail crossings
- The comfort, convenience, and safety of streets and paths that provide access to the Iron Horse Trail

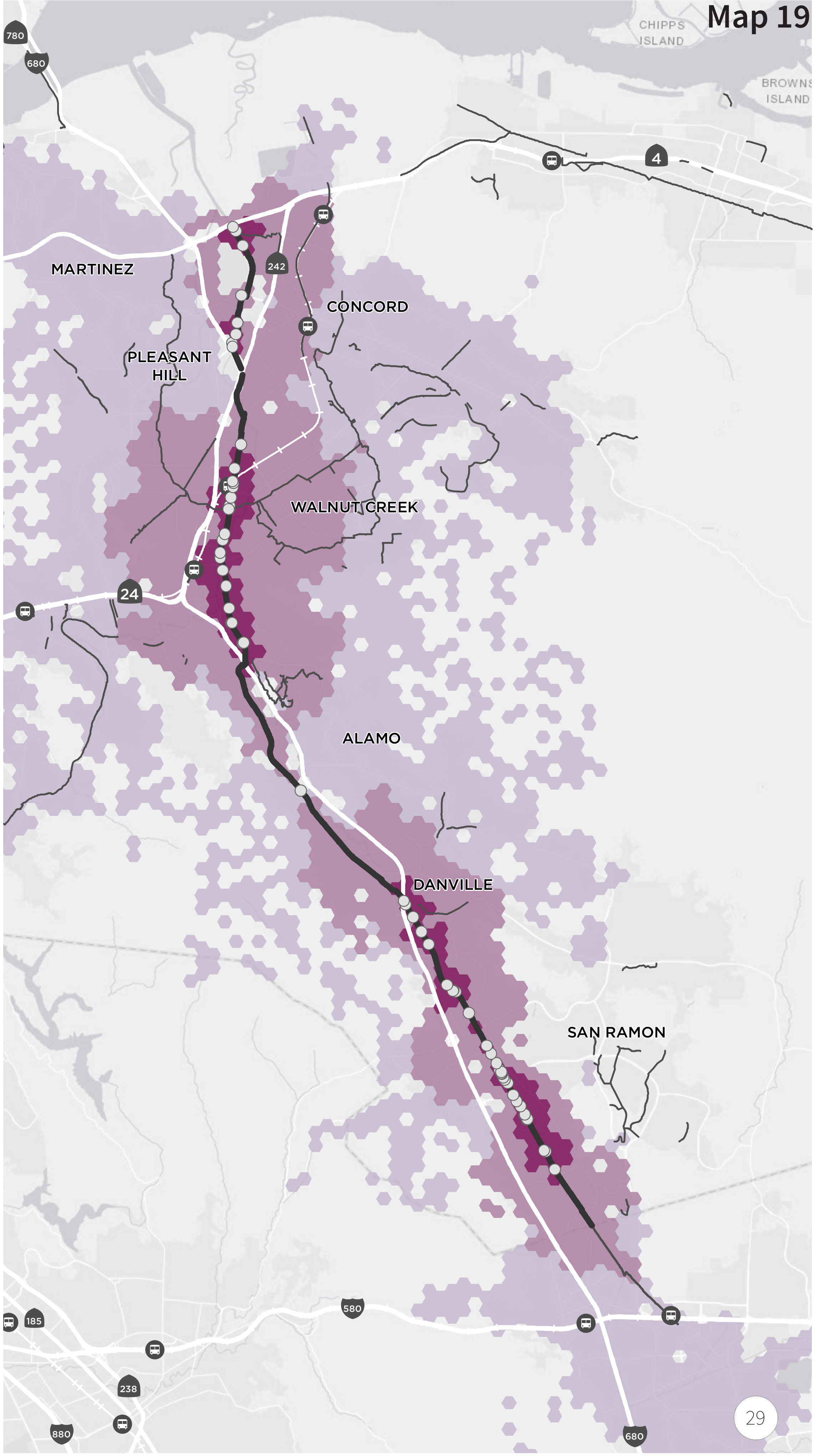
Using Map 19 as a baseline, the next step will identify how the combination of investments in the trail, crossings, and access routes will change who has access and by what mode. It will also further explore the opportunity for alternate modes—e-bikes, low speed electric vehicles, and others—to improve access to the trail for more residents and more trip types.

IRON HORSE TRAIL ACCESSIBILITY BY MODE

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Accessibility to Nearest IHT Access Point Along Low Stress Network

- IHT Access Point
- Walk (0 - 0.5 Miles)
- Bike (0.5 - 3 Miles)
- E-Bike (3 - 10 Miles)



- Iron Horse Trail
- BART Station
- Class I Shared-Use Path

MILES
0 1 2

N

alta PLANNING + DESIGN

Map produced February 2019.
Sources: U.S. Census, Esri, Contra Costa County, OSM.

IRON HORSE TRAIL ACTIVE TRANSPORTATION CORRIDOR STUDY

TECHNICAL MEMORANDUM #3 SHARED AUTONOMOUS VEHICLE (SAV) EVALUATION SUMMARY

October 21, 2019

304 12th Street, Suite 2A
Oakland, CA 94607
(510) 540-5008
www.altaplanning.com

MEMORANDUM

To: Jamar Stamps, Contra Costa County, Department of Conservation & Development, Transportation Planning

From: Emily Duchon and Brian Burchfield, Alta Planning + Design

Radin Rahimzadeh, Advanced Mobility Group (AMG)

Date: **October 20, 2019**

Re: Technical Memo #3: Shared Autonomous Vehicle (SAV) and Emerging Technologies Evaluation Summary

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Introduction

The purpose of this memo is to identify the mobility, safety, environmental, and economic benefits and constraints of introducing Shared Autonomous Vehicles (SAVs) and other micromobility options to the Iron Horse Trail corridor. As identified in previous memos, most walk and bike trips occur in the northern end of the trail, near Walnut Creek, Pleasant Hill, and Concord. Seventy percent of commuters along the Iron Horse Trail drive alone to work. Eighty percent of commuters have access to two or more cars. SAVs and other micromobility options could provide an alternative mode to alleviate worsening congestion patterns during peak periods as the population of residents and commuters grows in the cities along the Iron Horse Trail corridor. This memo investigates whether low-impact motorized modes such as SAVs, e-bikes, and e-scooters can be accommodated along the corridor, and provides a high-level assessment of the considerations of introducing these technology-forward options to the trail.

AB 1025

In 1978, Southern Pacific Railroad received federal permission to abandon the rail line that once ran along the Iron Horse Trail's current right-of-way. The County of Contra Costa obtained $10.6 million in grant funding to launch a feasibility study and pay for the partial acquisition of the San Ramon Branch Corridor's right-of-way. In 1986, the County entered into a license agreement with East Bay Regional Park District (EBRPD) to operate a 10-foot-wide paved multiuse trail within the right-of-way called the Iron Horse Regional Trail. The grant funding required the County to maintain a 34-foot-wide segment of the corridor for future mass transit use.

On October 12, 2019, the Governor approved Assembly Bill 1025, relieving the County of this obligation. With this new law in effect, the County has more flexibility in planning improvements in the Iron Horse Trail corridor.

Regional and National Context

Existing SAV Pilot Programs in Contra Costa

Two SAV pilot programs in the Contra Costa region have been tested to date. The first of these programs was a two-year study (2017-2019) by the Contra Costa Transportation Authority (CCTA) of low-speed, electric and autonomous EZ10 shuttles manufactured by EasyMile. The CCTA's SAV Program operated two generations of the

EZ10 shuttles, and Phase 1 of the study piloted the SAVs at the GoMentum Station, an Autonomous Vehicle Proving Grounds in Concord. Phase 2 of the study operated the vehicles at the Bishop Ranch Business Park in San Ramon. CCTA continues to test at Bishop Ranch. CCTA was also recently awarded federal grant funds to implement an Automated Driving System Demonstration Program (ADS) in Rossmoor, Martinez, and along the I-680 corridor.

The second pilot program will be deployed by the Livermore Amador Valley Transit Agency (LAVTA) to study the viability of SAVs as a first and last mile solution to connect local residents to the Dublin/Pleasanton Bay Area Rapid Transit (BART) station.

To date, SAVs in Contra Costa County have not transported general members of the public. Only pre-selected or volunteer passengers with signed waivers[1] have been able to board a SAV per the testing and demonstration agreement with the National Highway Traffic Safety Administration (NHTSA). Beyond Contra Costa, there are a number of shuttle programs that are in the pilot phase in cities such as San Jose and Sacramento.

With the continued testing of SAVs by the CCTA and LAVTA in cities that are connected by the Iron Horse Trail, there is an opportunity to collaborate and integrate these programs with the improvement recommendations developed in this Iron Horse Trail Study.

Electric Bicycles and Scooters

Electric bicycles or e-bikes are a relatively new but increasingly important mode of sustainable transportation. E-bikes benefit people who are interested in bicycling but may be limited because of physical fitness, age, disability, or because their trips are too far or the terrain too difficult to be completed by regular bicycle.

There are three key types of e-bikes:

- Class 1: E-bikes with a speed limit of 20 mph that must be pedaled to operate
- Class 2: E-bikes with a speed limit of 20 mph that can be operated by using a throttle
- Class 3: E-bikes with a speed limit of 28 mph that must be pedaled to operate

As of March 3, 2019, Class 1 and Class 2 e-bikes are allowed on select trails managed by EBRPD, including the Iron Horse Trail.

Electric scooters are also widely used on roads and trails throughout California, providing an efficient commute mode or first-last mile connection to and from transit stations. Maximum speeds typically range from 15-20 mph and maximum travel distances typically range from 15-40 miles.

Shared Micromobility

In the U.S., the three types of bike share systems commonly used are docked, dockless, and lock-to systems. E-scooter share systems are typically dockless systems. The costs to implement these systems vary by type (see Procurement + Cost).

E-bike share or scooter share systems provide users with on-demand access to e-bikes and e-scooters for one-way trips, and could present an efficient and sustainable commute option for users of the Iron Horse Trail. These systems could be implemented at shared mobility hubs, including at transit centers, BART stations, and Park and Rides.

[1] Signed waivers were required as part of the EZ10 vehicle testing study at Bishop Ranch. If the OEM is approved by the California Public Utilities Commission (CPUC) to join one of their pilot programs, the general public will be eligible to ride these SAVs if they are not charged a fee.

Currently, Bishop Ranch operates a bikesharing service entitled BRiteBikes. These bikes are allowed to be used on the Iron Horse Trail but are available to Bishop Ranch tenants only. At the northern end of the study area, Walnut Creek implemented a year-long bikeshare pilot program from January 2018 - February 2019.

Legislative and Institutional Requirements

National and State Policies and Regulations

SAVs

The Department of Transportation and National Highway Traffic Safety Administration (NHTSA) regulate autonomous vehicles on a case by case basis, and most of the regulation has been left to state governments. At the national level, if a vehicle does not meet Federal Motor Vehicle Safety Standards (FMVSS) then a waiver granting permission to test and/or transport passengers must be obtained. An additional waiver must be acquired if the vehicle is to be imported to the United States. Vehicles must acquire an additional waiver from the Environmental Protection Agency (EPA) if the vehicle is not considered to be a low-speed vehicle (weighing less than 3,000 lbs. and operating below a speed of 25 mph).

At the state level, the manufacturer must obtain a manufacturer's testing permit from the California Department of Motor Vehicles (DMV) as well as the Experimental Testing Permit from the California Air Resources Board (CARB). The California DMV also requires self-insurance by the testing manufacturer in the amount of $5 million.[2] To date, SAVs are not operating for commercial use and members of the public can only voluntarily support the testing and piloting of SAVs. A select number of manufacturers are participating in the California Public Utility Commission's (CPUC) Drivered AV Passenger Service and Driverless AV Passenger Service pilot programs. Each manufacturer who has been approved for these pilot programs would be issued at least two Transportation Charter Party-Carrier authorities—a separate certificate or permit for each AV pilot program.[3] Manufacturers that have obtained CPUC pilot program certification may include the general public in their testing.

It is important to note that many pilot programs have been paused or are operating within strict parameters as approved by NHTSA and the regulatory bodies of the states in which they operate. The manufacturers are required to be in direct communication with both NHTSA as well as the California DMV with updates on demonstration changes or intentions to expand demonstrations.

Micromobility

Scooter share systems first appeared in California in 2017. In the U.S., at least 17 states passed laws related to micromobility in 2019.[4] In California, two bills aimed at regulating new micromobility devices are being considered: one that would give cities power to regulate e-scooter operations, including banning them if they conflict with CEQA, and another that would require micromobility providers to be permitted by the cities they operate in.

Existing Legislation

At the local level, Assembly Bill 1025 recommends the investigation of new mobility options that can serve the over 1 million users of the Iron Horse Trail corridor, updating prior studies that did not recommend the use of motorized

[2] https://www.dmv.ca.gov/portal/wcm/connect/a6ea01e0-072f-4f93-aa6c-e12b844443cc/DriverlessAV_Adopted_Regulatory_Text.pdf?MOD=AJPERES

[3] https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/Licensing/autovehicle/AV%20Application%20Instructions.pdf

[4] https://micromobilitycoalition.org/news/

modes along the trail's right-of-way.[5] Additional local legislation includes AB 1592, which although expired, recommended that CCTA be authorized to conduct testing of Society of Automotive Engineers (SAE) Level 4 vehicles at the GoMentum Station.[6] AB 1444 authorizes the Livermore Amador Valley Transit Authority to conduct a SAV demonstration project to test autonomous vehicles.[7]

Assembly Bills 1112 and 1286 both aim to give cities power in regulating micromobility options. Both bills have been put on hold until informational hearings are held.

Technical Requirements

SAV Specifications

The design of shared autonomous vehicles varies, with capacity ranging from six to twenty passengers. The maximum number of passengers a driverless vehicle can accommodate is 20 passengers (14 seated positions and 6 standing positions, depending on passenger needs and configuration). SAV models vary on the inside depending on the number of seats and their arrangement. An optimal model has not yet been identified by the market or by regulators.

SAVs are designed to the traits of the SAE Level 4, do not have a steering wheel, pedal, or brake, and do not require additional infrastructure, operating autonomously following a virtual line mapped and loaded in the software of the vehicle. When batteries are fully charged, the vehicles can operate up to 14 hours. Almost all SAV designs are considered low-speed and lightweight vehicles both by national EPA standards as well as local CARB standards. Dimensions of the SAV vary slightly, but an example model's dimensions are as follows: L13' x W6' x H9. SAVs may operate at a top speed of 25 mph, but typically operate at 12-15 mph during the pilot phases.

May Mobility- 6-person vehicle.

Easy Mile, EZ10 – 10 to 12-person vehicle

Local Motors, Olli – 8-person vehicle

Coast Autonomous- 14 to 20-person vehicle

SAV Requirements

Currently, the proposed SAV requirements consist of series of systems and sub-systems:

- SAV (Vehicle, hardware and software);
- Parking, covered storage and charging station for SAVs;
  - Charging requirements may vary across each SAV manufacturer. The EZ10 vehicle requires 220V 32amp.
- Fleet automation platform and apps;
- Mobility on Demand (MOD) application;

[5] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201920200AB1025
[6] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB1592
[7] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB1444

- Transit agency's Computational Aided Dispatch (CAD)/Automated Vehicle Location (AVL) systems; and
- Roadside Equipment and Necessary Adaptation for SAVs with respect to vehicle to infrastructure (V2I) and vehicle to everything (V2X).

When operating within an existing roadway, the SAV may not require additional infrastructure to operate safely along a fixed route. However, some infrastructure improvements that will need to be evaluated for the Iron Horse Trail include but are not limited to:

- Trail widening
- Installation of fiber
- Dedicated Short Range Communication (DSRC)
- Intersection/signal improvements
- Striping and Signage

If the SAV is operating on public roads, additional traffic infrastructure is needed. This includes Dedicated Short Range Communication (DSRC) which would require the deployment of tens of thousands of Roadside Units (RSUs) embedded or attached to roadway infrastructure to enable an effective network along local roads. If available, LTE and 5G can be used for these RSU functions thereby eliminating the need for highway authorities to install and maintain RSUs. In addition to the increased vehicular safety and traffic efficiencies, 5G-based V2X technologies would provide significant capital and operational cost savings. The city transportation system can gather real-time data, analyze the traffic pattern and apply deterministic traffic congestion algorithms for better road management and improved infrastructure planning.

The sensor technology used for SAVs require clearly visible pavement markings and signs when operating on trails and roadways which may require additional improvements along the Iron Horse Trail. While a human driver may be able to interpret faded or absent pavement markings and continue within the designated lane, a SAV may need to more clearly "view" where to position itself on the pavement as guided by its mix of cameras and other sensors like radar and lidar. Furthermore, with respect to the designated route selected, additional signage and stop locations may be needed to institute safe traffic conditions for SAV passengers, micromobility users, bicyclists, and pedestrians.

SAV Testing and Operation

SAVs can currently only be implemented through regulated pilot programs. A successful SAV pilot program is designed by both private and public partners and combines the necessary perspectives to create an innovative real-world mobility solution for various and nuanced segments of the corridor. The pilot program should have a defined goal—such as connecting employees to transit stops or elderly residents to services—that can help define the route and attract users to the program. Numerous stakeholders must be involved in the process and given the opportunity to share their input and provide feedback on the proposed routes.

Potential partners include:

- Public Sector
    - Contra Costa Transportation Authority (CCTA)
    - Metropolitan Transportation Commission (MTC)
    - Bay Area Rapid Transit (BART)
    - Bay Area Air Quality Management District (BAAQMD)

    - County Connection
    - Livermore Amador Valley Transit Authority (LAVTA)
    - 511 Contra Costa
    - City agencies and local county representatives
    - School and parent associations
    - Local law enforcement from each of the nine cities
- Private Sector
    - SAV OEM
    - Sunset Development (Bishop Ranch)
    - Chosen SAV operator

The Operational Design Domain (ODD) may include 2-4 proposed test routes to pilot the program and monitor its operations. The ODD must be approved by the California DMV and NHTSA for the period of 1 year.

Procurement + Cost

A well-defined Request for Proposals (RFP) that outlines the role, service responsibilities, and communication of a vendor(s) along with a cost estimate for infrastructure improvements, shuttle(s) operations, reporting, and media for the duration of the contract period, is critical to the success of the procurement and demonstration process.

A summary of cost estimates for operating a SAV program is included in the table below. Also included are estimated costs for operating two new mobility technologies: e-bikes and e-scooters.

System	Cost Type	Item	Cost Range	Notes
SAV	Operational	Vehicle	$100k - $250k	Dependent on vendor
	Operational	Storage	$30,000	Covered storage
	Operational	EV Charging Station	$15,000	Per station
	Operational	Maintenance	$12,000	1 year
	Testing	Pilot program	$120,000	1 year
	Infrastructure Improvement	Dedicated path	$500,000	Per mile, contingent upon site context
		Fiber installation	$300,000	Per mile
		Intersection/signal improvements	$50,000-$300,000	Ranges from existing signal improvements and modifications to intersection reconfiguration and utility relocation
		Pavement markings	$25,000	Per mile
		Signage	$5,000	Per mile

System	Cost Type	Item	Cost Range	Notes
Docked e-bike share	Operational	Charging Station w/ 8-10 bikes	$45,000 - $55,000	Owned by city, business, or nonprofit group
	Operational	Operations & Maintenance	$2,000 - $2,500 per bike annually	Usually paid for by sponsorship, user fees, and city/state grants
Dockless e-bike share	Operational	Bicycle	*No cost	Typical business model is to provide system at no cost in exchange for operator flexibility in setting prices, establishing a service area and keeping sponsor revenues. Includes charging, storage, and maintenance costs.
Lock-to e-bike share	Operational	Charging station w/ 8-10 bikes	$20,000 - $25,000	Owned by city, business, or non-profit group
	Operational	Operations & Maintenance	$2,000 - $2,500 per bike annually	Usually paid for by sponsorship, user fees, and city/state grants
Dockless e-scooter share	Operational	Scooter	*No cost	Typical business model is to provide system at no cost in exchange for operator flexibility. Includes charging, storage, and maintenance costs.

During the procurement process, it is critical to include any anticipated permits in the procurement documents to help any potential vendor set expectations early. It is also important to define all infrastructure requirements and impacts so there is an expectation and awareness of impacts that might affect the deployment schedule. All details and expectations regarding data aggregation, sharing, and reporting should be clearly defined in the proposal by the project team to ensure the procurement documents have the appropriate information.

Stakeholder Coordination

A SAV pilot program will involve coordination work with local jurisdictions, residents, community groups, and law enforcement to provide the public with adequate knowledge of the pilot program prior to initiation. It is important to identify all potential risks and mitigation processes prior to initiating the program. One such example would be to create a law enforcement and emergency response interaction plan for the corridor.

Establishing a working group structure is recommended to keep partners engaged and apprised of project developments, as well as to provide a forum with which to discuss critical decisions.

Additionally, it is important to take residents' feedback into account. The operation of SAVs may evoke contention from residents and community groups whose homes reside near the trail. This may be due to increased fast travel modes on the trail, perceived potential safety issues, increased noise pollution, or additional and new types of maintenance activity. Communication channels such as a dedicated website page to highlight project updates and provide a forum for community participation may increase project support and stakeholder buy-in.

Geometric and Right-of-Way Constraints

SAV shuttles will not be able to operate on segments of the trail that are width-constrained or poorly maintained. Improved trail infrastructure to accommodate SAVs will impact zoning requirements, especially in the realm of site design, and curbside pickup/drop-off zones will impact adjacent streets.

There are significant physical constraints for SAVs to operate end to end on the Iron Horse Trail. Some trail corridors are constrained to only 25 feet to 30 feet. With consideration of safety for all modes, creating a dedicated SAV travel lane or SAV two-way lane in these areas may limit the capacity to accommodate existing modes of travel (e.g., bicyclists, equestrians, and pedestrians). Furthermore, limited rights-of-way at road crossings create pinch points for SAVs, pedestrians, and people riding bicycles and would need significant capital improvements to be reconfigured in order to accommodate all proposed modes of transportation.

Due to physical constraints, consideration of SAVs on the Iron Horse Trail may be more applicable along targeted areas of the trail with wider rights-of-way, higher expected demand, and connection to major regional destinations such as BART stations and Bishop Ranch.

Additional Considerations

Accessible Transportation

According to a study conducted for the American Association of Retired Persons (AARP), roughly one-third of people with disabilities who never leave their home do not leave because they do not have any means of transportation available to them. Most of those with disabilities who do travel, do so in private vehicles. The most significant travel barriers for people with disabilities is related to barriers and obstacles in the built pedestrian environment. The opportunity to arrive at priority destinations, such as BART stations via SAVs could result in a mode-shift among people with disabilities.

First/Last Mile Solution

The SAV is a potential solution to providing first/last mile connections to other fixed-route services such as transit. Research shows that by solving for first/last mile challenges, travelers will be more inclined to use traditional public transit, especially fixed-route rail and bus service for regional trips due to relative convenience versus the cost of enduring traffic and congestion.

Along the Iron Horse Trail, SAVs could potentially group trips as a feeder to fixed-route travel on regional transit such as Pleasant Hill/CCC and Dublin/Pleasanton BART.

Micromobility options such as e-bikes and e-scooters can also provide first/last mile connections to transit. People using e-bikes and e-scooters could use the same lanes as those designated for other fast user groups such as adult bicyclists, providing more mobility options within the existing right-of-way.

Reduction in Vehicle Miles Traveled (VMT)

Congestion along I-680 could be reduced if SAVs provide viable connections to transit. A mode shift away from personal vehicles to active or SAV connections to transit would reduce vehicle miles traveled (VMT). This reduction would result in associated positive environmental and health benefits (i.e. reduction in GHG emissions, personal transportation cost savings, etc.).

Safety

NHTSA estimates that connected and autonomous vehicles such as the SAV could eliminate or mitigate 80% of crashes where the driver is fully attentive (i.e., not impaired, distracted, or drowsy). Furthermore, The Iron Horse Trail corridor features a number of roadway crossings, and by reducing congestion and vehicles on the road, these crossings may experience safer conditions and fewer crashes.

Limitations on SAV Multimodal Performance

The SAV has been tested to successfully navigate multimodal separated use conditions where other modes are traveling parallel to the vehicle. However, if the SAV does not operate on a linear route and is required to turn left or right in a multi-modal condition, the vehicle may not perform optimally. At this time, SAVs are undergoing testing to aggregate more statistically significant data to determine capability of successful left and right turns. If the SAV vehicle only operates on a linear path along the Iron Horse Trail, without turns, it would be able to transport travelers from one destination to the next.

The performance of the SAV is conditional based on the number of perceived obstacles on the trail. The SAV slows down when it registers a potential obstacle and comes to an abrupt stop, especially when a large object enters into its trajectory. Since SAVs have not been rigorously tested in compact shared-use multimodal environments, it is unknown at this time how the SAV will operate on the Iron Horse Trail in shared-use conditions. A dedicated route for the SAV would provide a more optimal condition for the current technology.

A potential negative outcome could be unpredictable delays. A SAV could stop for harmless nuances in the environment where the SAV incorrectly perceives a barrier and stops. Seeing as the vehicle has not been tested in a natural environment that include plants, trail debris, and wildlife, it is not yet determined what the vehicle would perceive to be an obstacle. If the vehicle is very sensitive to the environment, it would not be a viable mode of travel especially for people traveling to education or employment centers within specific time constraints.

Integration with Existing Trail Users

Integration of the SAV with existing mobility modes along the trail may prove challenging as present-day users of the trail have complained about the challenges of interactions between pedestrians and bicyclists on the trail. The addition of a larger motorized vehicle may produce further cultural differences between co-existing modes of mobility.

Preliminary Recommendations + Next Steps

Given existing technology constraints, potential SAV routes along the Iron Horse Trail were evaluated based on available right-of-way, presence of physical constraints, existing and potential user demand, and connections to key destinations such as transit and employment centers. Locations for shared mobility hubs that could store these vehicles and provide charging stations for both SAVs and micromobility devices were also considered.

Two sections of the trail were identified as potential locations for a future SAV pilot program: Monument Boulevard to Ygnacio Valley Road in the northern section of the corridor and San Ramon Valley Boulevard to the Dublin/Pleasanton BART Station in the south. These sections of the trail have available ROW to accommodate SAVs, offer connections to employment hubs, and have the ability to serve as links to transit, helping to solve first-last mile challenges along the corridor.

These are preliminary considerations only. Further study will be required to refine possible SAV routes and determine the most efficient use of resources in implementing a SAV pilot program for the corridor. Additionally, infrastructure improvements, including intersection improvements, would be required to implement a SAV pilot program for the Iron Horse Trail.

IRON HORSE TRAIL

CONTRA COSTA COUNTY
IRON HORSE TRAIL

Potential Early Action SAV Corridor

Potential SAV Corridor

BART Station

Park & Ride

MILES
0 1 2

N

Map produced September 2019.

IRON HORSE TRAIL

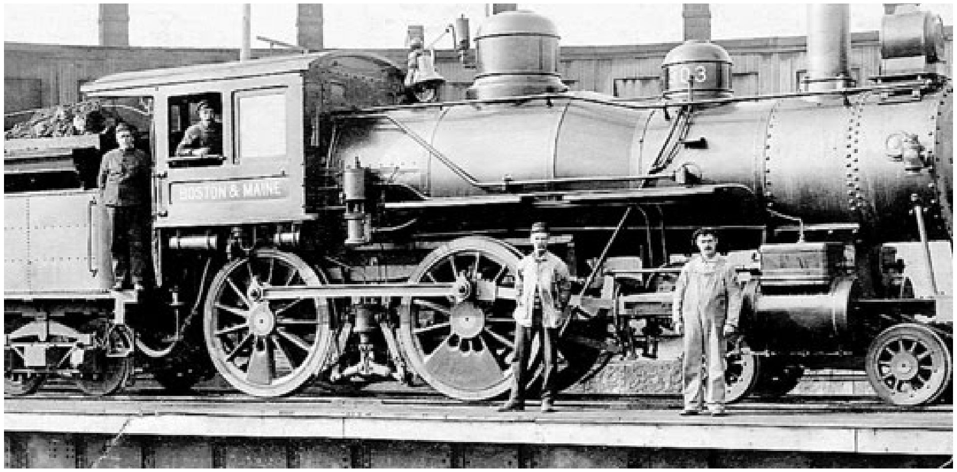
LOGO CONCEPTS V4

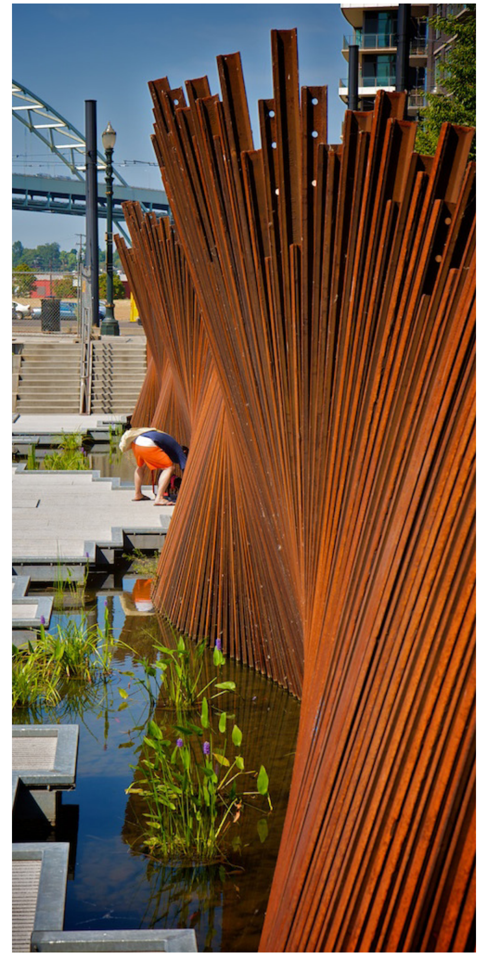
Prepared by Alta Planning + Design | 04.05.2019

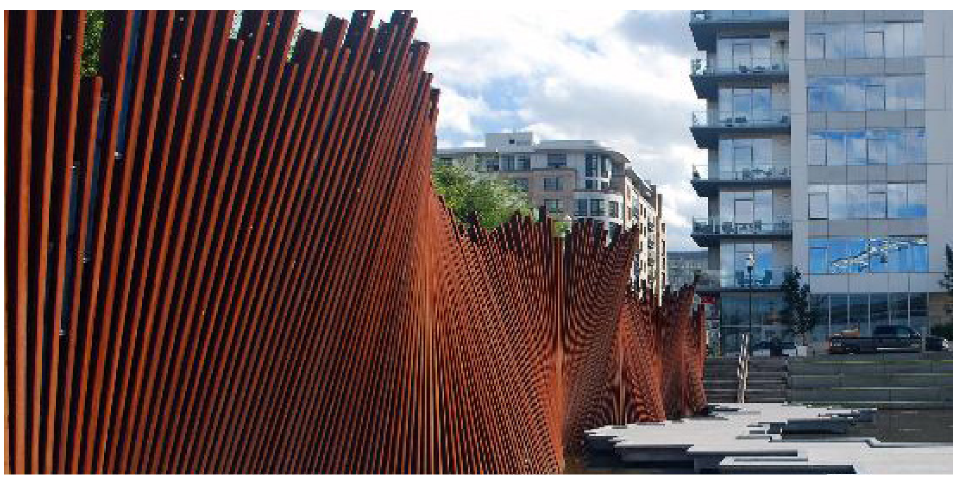
CONCEPT 01

TRACKS 1

Bold illustrated monogram


BOSTON & MAINE





CONCEPT 01: TRACKS 1

1.a

IRON HORSE

REGIONAL TRAIL

Note: color palette, typography and illustration may be refined in the next round of design.

CONCEPT 01: TRACKS 1

1.b knockout

Note: color palette, typography and illustration may be refined in the next round of design.

CONCEPT 01: TRACKS 1

Medallions: simplified monogram-style logo suitable for pavement marking, stickers and other marketing collateral

1.c

1.d

1e

1.f

Note: color palette, typography and illustration may be refined in the next round of design.

CONCEPT 02

TRACKS 2

Iconic, elegant, interconnected, linear

IRON
HORSE
REGIONAL TRAIL

2.a

IRONHORSE
REGIONAL TRAIL

2.b

Note: color palette, typography and illustration may be refined in the next round of design.

IRONHORSE
REGIONAL TRAIL

2.c

IRONHORSE
REGIONAL TRAIL

2.d

Note: color palette, typography and illustration may be refined in the next round of design.

CONCEPT 03

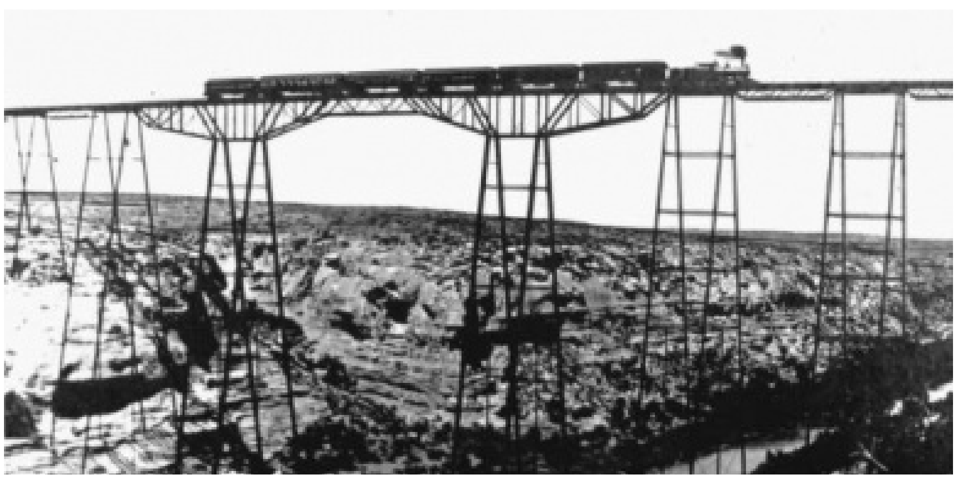
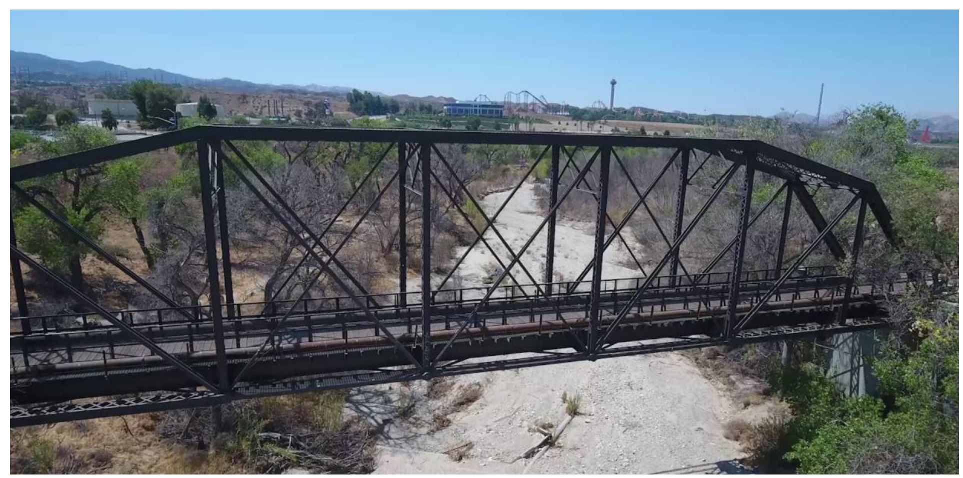
BRIDGES

Connection, infrastructure, historic + contemporary





Treat Blvd

CONCEPT 03: BRIDGES

3.a

Note: color palette, typography and illustration may be refined in the next round of design.

IRON HORSE
REGIONAL TRAIL

3.b

IRON HORSE
REGIONAL TRAIL

3.c

Note: color palette, typography and illustration may be refined in the next round of design.

thank you!